Death Valley
The Facts

W. A. Chalfant

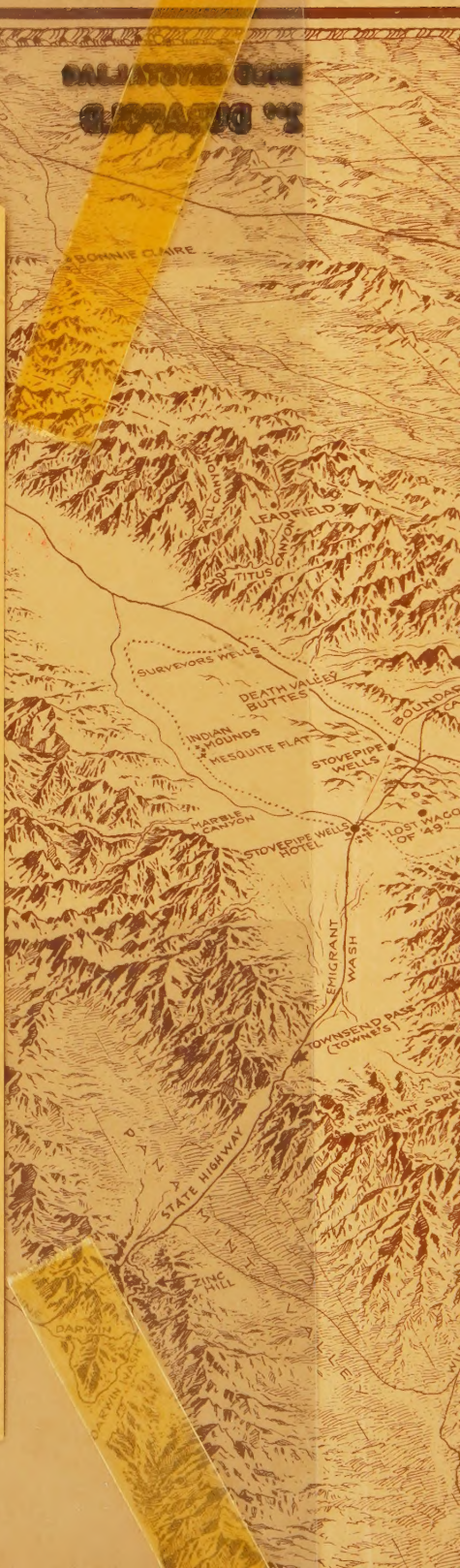
Third Edition

Death Valley
The Facts

By W. A. CHALFANT

"Only one writer has ever told the complete and authentic story of Death Valley, famed the world over for its singular beauty and correspondingly notorious for its weird desolation and sinister past. He is W. A. Chalfant, and his book *Death Valley: the Facts,* is now out in a revised edition. The volume has been brought down to date, includes additional illustrations, such as the Natural Bridge and Scotty's Castle, and further interesting data, in a distinctive purple-and-drab cover. It is an absorbing account of every phase of the strange deep sink and its environs, now an immense national monument and popular resort."—*Westways.*

"Books like this are rare, and it's no wonder that the third edition is already off the press," said Mr. Wheaton H. Brewer in his radio review. Instead of this volume of facts and serious conclusions based on painstaking investigation being dull, uninteresting reading, he found it "startling and truly exciting."



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DEATH VALLEY

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Photo by Willard

Death Valley from Dante's View

DEATH VALLEY

THE FACTS

BY

W. A. CHALFANT

Author of *The Story of Inyo,*
and *Outposts of Civilization*

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FOREWORD

Writers on Death Valley, the Tomesha (ground afire) of one of the Indian tribes, have drawn heavily on the vocabulary of descriptive terms. They tell us the Valley is bizarre, fantastic, weird, mysterious, fascinating, wonderful, grim, forbidding, sinister, serene, even charming. We read of its flaming sun in a blazing sky, its glaring landscapes, its shadowy recesses, and its silent, brooding night with stars in velvet depths. Each writer has seen there the qualities he anticipated and has found inspiration for his most graphic adjectives. It is a paradoxical land, they say, knowing alike the waves of shimmering heat and the balmy haze of delightful, dreamy Indian summer. On the one hand lies salt a thousand feet deep; on the other, during the right fortnight, flowers tinge the gray sands. Lives have surrendered to thirst, yet it is better watered than most deserts, wild fowl make it a way station in their migrations, and floods strip the covering from the mountain ribs. There has been much of such description, to the neglect of prosaic details. The matter-of-fact inquirer for knowledge has found it, if at all, in dilute form.

This volume attempts to supply information, without emulating the prose-poets. Facts and serious conclusions herein are worthy of credence not because of where they are found so much as because they are based on painstaking investigation. Documents and reports and the findings of skilled specialists fortify gleanings from other reliable sources as well as personal observations in trips covering the Valley practically from end to end and from side to side.

Grateful acknowledgment is made for generous cooperation. Unlimited selection has been permitted from the fine collections of pictures taken by Mr. Burton Frasher, of Pomona, California, and Mr. Stephen Willard,

of Palm Springs, California; and Mr. Frasher also secured special views while with the author and others on a Death Valley expedition. The illustrations frequently tell the story as words cannot.

The kindness of Professor W. L. Jepson, California's foremost botanist, in reading and correcting the manuscript chapter on his special study gives it an authenticity which readers cannot fail to appreciate. Assistance by Mr. Robert Kessler, of Los Angeles, in botanical information, is appreciated.

Notes on the desert sheep are from information supplied by Mr. E. H. Ober, ranking as one of the highest authorities on that subject.

Publications of the Weather Bureau, the Department of Agriculture, and the War Department have been drawn upon freely, some of the out-of-print material being courteously supplied from headquarters. The resources of the California State Library and of the library of the Nevada State University have contributed items, and many individuals have responded most kindly to various requests.

Not least among those who have helped this undertaking is Mr. W. A. Crosby, Automobile Club of Southern California representative in Bishop, California. His genial companionship and resourcefulness have made pleasant the weary miles of repeated desert journeys.

These chapters unavoidably cross some of the trails followed in *The Story of Inyo* (Chicago, 1922). Further attention to Death Valley was not contemplated when that book was prepared, otherwise only the historical features would have been included in it. However, duplication of matter has been avoided so far as may be, and the historical details in this volume are more accurate and more complete.

W. A. Chalfant

Bishop, California
November 30, 1929
(Revised August 3, 1936)

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[Cover design adapted from photo by Frasher's]

DEATH VALLEY

I. SOME GEOGRAPHICAL FACTS

Death Valley is on the western side of the Nevada-California line, between parallels of latitude 35 degrees 30 minutes and 37 degrees 10 minutes and meridians of longitude 116 degrees 10 minutes and 117 degrees 20 minutes. These parallels and great circles, noted roughly and not from survey notes, touch the extreme points. Measured between foothills of the bordering ranges, the distance from the foot of Last Chance Canyon, at the northwestern end of the Valley, to the southeastern point near Saratoga Springs is somewhat over one hundred and thirty miles. The width varies from six to fourteen miles, except midway of the length; there it narrows, and the axial direction, which through the southern section is northwest and southeast, swings slightly to the westward.

Mountains rise sharply on both sides. At one point on the east about 6,000 feet elevation is gained in a horizontal mile. But from the foot of that precipitous slope in the Black Mountains, the surface stretches westerly across the Valley for seven miles before rising above sea-level; and for four miles more, to the steep slopes of the Panamint Mountains, the rise is approximately one foot in ten. Then the climb is rapid to the summit of Telescope Peak, dominant point of the range, 11,045 feet above the tides and nearly thirty miles from the crest of the eastern barrier. Telescope, though not in what is considered a great range, towers above the land at its foot as does no other peak in the United States. Its full height, starting from the plain below the sea, is visible, while Mount Whitney, more than 3,000 feet higher in its Sierra setting, rises from a plateau almost 4,000 feet in elevation and is no more imposing—less so, in fact, because of its rival neighbors.

The Panamint range, high and rugged, bounds the west side of the Valley except at the broad and extreme north end, where some miles of the Last Chance range are seen.

Probably their name has much to do with making the Funeral Mountains most noted among the ranges of the region. A former tendency to designate the whole eastern wall the Amargosa range seems to have given way to the more somber titling. The Funerals face the Valley's mid-section, in a welter of tumbled hills and peaks and a weird array of coloring—light slopes and black capping. The highest peak of the range has 6,850 feet elevation, but one need not climb to that altitude to overlook a rare display of broken surfaces.

The Grapevines, to the north, have a longer Valley frontage, rise to greater heights, and offer some of the most impressive scenery to whoever may invade their canyons. Their culminating point is Grapevine Peak, 8,657 feet.

Interposing between the southern point of the Funerals and the greatest depression of the Valley, the Black Mountains rise almost cliff-like from the salt beds and sand.

Roughly estimated, about four hundred square miles of Death Valley lie below sea-level. The sea-level contour incloses an area more than seventy miles long, and varying from six miles wide, at Mesquite Flats, to one mile, a little to the south, and again to more than six miles opposite Furnace Creek Ranch. Within this contour, slopes are hardly perceptible. A bench mark at Furnace Creek Ranch reads −178; eight miles south the mark is −274. The maximum depth established by the Geological Survey is ten miles farther southwesterly, not far from Bennett Wells; there the figures are −276.

A belief of long standing is that the Valley has been, at all times during this geological age, the lowest dry land on the continent. Now comes the Geological Survey, in a

bulletin released July 8, 1928, with the statement that prior to 1905 the low-level record really belonged to the Salton Basin, the bottom of which was −280 feet. In that year the Colorado, breaking its banks, created the Salton Sea, with a shore-line level of −244. Since then evaporation has disposed of six feet of the depth, leaving a present water level of −250. Before the Colorado broke loose to recreate the sea which had probably existed and wasted away more than once in the past, Death Valley's supremacy was unquestioned, the level of −427 being then accepted!

If the Survey does not further revise its figures, Death Valley may be officially but not correctly relegated to second place by the inevitable drying up of Salton Sea to its −280-foot bottom.

Seen from Dante's View, drainage lines run toward what is called Bad Water, sixteen miles south of Furnace Creek Ranch. The observer will say without hesitation that there lies the lowest point, though no United States Geological Survey measurement of its depth has been made. Borax company officials state the Bad Water level to be −310, basing the figures on observations by company men and Nevada engineers.

Almost midway of the length of the Valley the mountains draw nearer together, and low sedimentary hills fill part of the narrow floor. This gives some excuse for considering the northern arm a separate valley, though the reason for a distinction is no more obvious than it would be for a like separation in Owens Valley, California, farther west, which is similarly constricted. Below-the-sea contours continue past the hills, northward to and around Mesquite Flat. The latter is the site of the great sand dunes, of Stovepipe Wells, and of other points of interest commonly considered as being in Death Valley.

A government report of 1892 refers to the southern section as "Death Valley proper" and to the upper part as

"Lost Valley." Even the desert-wise sometimes employ the former term. But the Geological Survey ignores "Lost Valley" as a name for the northern arm, and accepts as Death Valley the whole magnificent sweep of lowlands and ascents to the encircling mountains that bound the watershed, without qualifying names except those of purely local application such as Mesquite Flat. So it should be. The salt beds of the southern arm and the dunes, crater, and petrified forest of the northern are all part of Death Valley, as are the wondrous canyons opening into each section. The topography, as shown by official spirit leveling or, better still, by the experience of a journey from one end to the other of the Valley, will emphasize the fitness of there being but one name. It is no more logical to limit it to the salt fields than it would be to consider the burning cup of Mauna Loa the whole volcano.

The widest measurement between foothills is on a line from Death Valley Buttes through Stovepipe Wells, about fourteen miles. The greatest width of Valley floor south of that is ten miles, at a point some twenty-six miles south of Furnace Creek.

A great deal of the area is like that of any other desert, neither more dangerous nor less so, presenting the same general features and with more than the average desert supply of watering places. Less than forty miles of distance separate its westernmost rim from the nearest point in Owens Valley, but these are forbidding miles, as arduous to travel as most of Death Valley itself.

The character of the terrain in all directions explains the scarcity of popular reliable information. Until the coming of somewhat better roads and speedy automobile transportation, few but the ubiquitous prospector and the most venturesome among sightseers braved the discomforts of the Valley itself and the hardships of even reaching it. Space writers, knowing the improbability of their imaginings being challenged, built tales on shreds of foun-

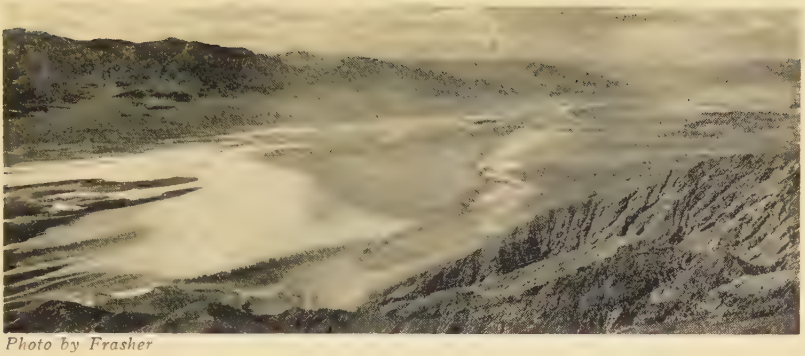

Photo by Frasher

Southern arm of Death Valley from Dante's View

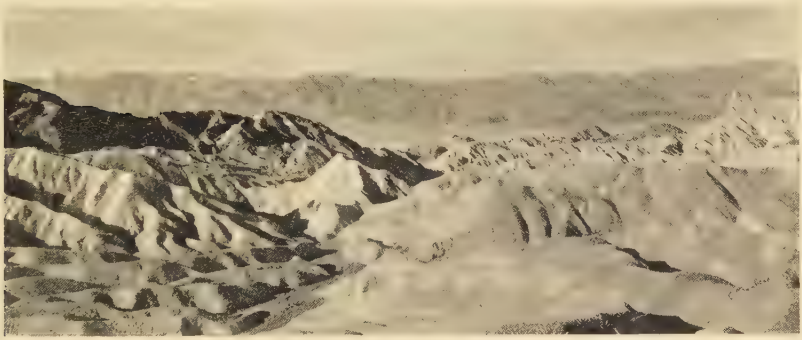

Photo by Frasher

In the Funeral Range

Photo by Frasher

Furnace Creek Inn

dation, until the really informed felt, with an American humorist, that "it is better not to no so mutch than to no so mutch that ain't so."

Less of such fantasies have appeared in print in more recent years, but some samples of early misinformation, taken from a generous collection, may here be submitted.

Harcourt, an author writing in the *Overland Monthly* in 1908, said:

> Early government reports are bristling with inaccuracies. No reliable surveys were made until 1880. One early government explorer stated that the Amargosa River was navigable for a considerable distance.

That explorer deserves classification with the one who supplied what purported to be the first surveys. When the borax locators began running their lines, they found land officially described as level to be in fact slopes of 45 degrees or more. So while presumable authorities kept so far from facts, it is not strange that others let their imaginations run riot about that unknown land.

So careful an authority as the *Scientific American,* publishing in 1885 some comment on the climate, approved the statement, "it is certain that no man could survive there long enough to secure continuous observations of any kind." Yet borax production had already become important and company caretakers were staying through all seasons.

The hardly less conservative *Chautauquan* informed its readers in 1891:

> Animal life is confined to the most repulsive forms, such as the lizard and rattlesnake, scorpion and tarantula, the horned toad, and in some months gnats. Occasionally a few blackbirds and crows hover about, but usually only in the train of the traveler in the hope of finding food in the scraps left behind.

Again the *Chautauquan,* on another detail:

> One does not need burial, for the body will not decay, but will simply be shriveled up to a mummy and lie there to an eternity, im-

perishable, staring up at the burning sky. Here and there all over the awful plain of salt and alkali are scattered the dead bodies of men and animals preserved for all ages to come.

This paragraph had many reprintings in the 'seventies:

Death Valley is 30 miles long by 30 broad, and totally devoid of water and vegetation, and is surrounded except at two points by inaccessible mountains. The shadow of a bird or wild beast never darkens its white glaring sands. The Kansas Pacific railroad engineers discovered it, and also some papers which showed the fate of the lost Montgomery train. . . . . Around the valley they wandered and one by one the men died and the panting flocks stretched themselves in death under the hot sun. After a week's wandering a dozen survivors found some water in a hollow in a rock in the mountain. It lasted but a short time, when all died but two. Eighty-seven families and hundreds of animals perished there.

Cronise's *Natural Wealth of California,* an oft-quoted early authority, gives the dimensions of the Valley on one page as 100 miles by 20, on another as 40 by 8 or 10.

Even so recently as 1922 a book[1] asserted of Death Valley:

This desolate valley is 40 miles long, destitute of all vegetation and totally without water.

When the space writers turned themselves loose on the animate life they outdid their ordinary efforts. This was printed in a Coast paper:

In the early spring gnats of great size sweep over the place in swarms of millions. Coyotes prowling around the fringes of the valley have been stung to death. . . . . There is a peculiar kind of mouse which lives wholly on the scorpions which thrive there by the tens of thousands. Another variety of mouse consumes the centipedes.

Public opinion was shaped by such paragraphs and alleged descriptions. The samples given may stand rereading after a perusal of the facts in these chapters.

[1] *Spanish and Indian Place Names of California.*

The author must admit having himself erred in some details given in references in *The Story of Inyo.* There the extreme depth of the Valley is stated as 427 feet. That is the figure given by Gannett's *Dictionary of Altitudes,* published by the Geological Survey in 1906, and accepted by the State Mining Bureau's *Saline Deposits of California* and other publications. Sydney H. Ball's *Geologic Reconnaissance, United States Geological Survey Bulletin 208,* says:

> The lowest point of Death Valley within the area mapped is about 280 feet below sea-level, but 15 miles farther south the depression is at least 125 feet deeper.

More recent spirit leveling by the Geological Survey, the final authority, corrects its own and other estimates and gives the officially measured lowest level as −276, at a point not far from Bennett Wells.[2] As already mentioned, this is probably not the greatest depth.

Also, *The Story of Inyo* referred to Towne's Pass as being in the Funeral range, instead of in the Panamints. If there are other contradictions, these chapters are the more nearly correct.

William Lewis Manly appears to have been the creator of the ominous name. Writing of the escape of the ill-fated emigrants, he says:

> We took off our hats, and then, overlooking the scene of so much trial, suffering, and death, spoke the thought uppermost, saying: "Good-bye, Death Valley!" Even [doubtless a misprint for "ever"] after this . . . . it was called Death Valley. Many accounts have been given to the world as to the origin of the name and by whom it was thus designated, but ours were the first visible footsteps, and we the party which named it the saddest and most dreadful name which came to us from its memories.

If in the days when Manly wrote there were other versions, they seem to have faded completely, and it is now generally accepted that the christening was done because

[2] *Furnace Creek Quadrangle,* edition of 1920.

of and by the emigrant party. Certainly it paid dearly for the privilege; let us leave with it the honor of giving a name which has endured through a period of supplanting picturesque pioneer designations with more conventional ones. No change in it has been suggested; probably none will be. It is too completely appropriate to be disturbed. Neither has there been any effort to apply it to any other locality. There is but one Death Valley in name, just as there is but one in array of distinctive characteristics.

And yet it is not wholly amiss to question the name being the inspiration of the moment. Was that spoken good-by at the last gaze across the desolation its first use? Probably not; during the cheerless days and weary nights of their martyrdom the unfortunates must have coined some title for their surroundings.

Some names originally given to places and objects around the Valley are still in use, such as Furnace Creek, Amargosa, Grapevine, Last Chance. Some have been changed: Hadley's Springs have become Texas Springs, McCormack's Wells are now unknown by that designation, and so with some others. It is now believed that McCormack's Wells are identical with Tule Spring.

Two changes have been made (one perpetuated by the Geological Survey maps) which should be vetoed by the public. Townsend Pass of some present-day maps was originally Towne's Pass, so styled and so accepted by pioneer usage; and while there seem to have been men of each name among the emigrants, Towne's name was the one taken. The original "Towne" has been adopted by the National Park Service and is on the way to official acceptance. It was chosen by Dr. Darwin French in 1860. Lost Wagons is now shown far from the camp of '49, miles from where the wagons were burned. It was named in 1905 by a Geological Survey party. It marks a place where a wagon was abandoned many years later, but the special title is so much

a part of the emigrant story that it should be used only in that connection.

How the present "Lost Wagons" spot got its designation is told by C. B. Zabriskie, executive head of the Pacific Coast Borax Company:

The borax company's wagons were lost between Mesquite Flat and the old Jake Steininger ranch, now Scotty's. In 1889 I went to Death Valley as a representative of the Pacific Coast Borax Company, who had purchased all of the Death Valley properties from the assignees of William T. Coleman & Co. I took with me six men. One of the 20-mule teams formerly owned by Coleman was at Furnace Creek Ranch. It was my plan to load up the wagons with the materials that we could use in Nevada and drive the 20-mule team with the wagons from Furnace Creek Ranch to Columbus.

In the inventory there were listed 180 sacks of grain. This I noted, as it gave an assurance of having proper feed, with the alfalfa we could bale at Furnace Creek Ranch, for the team for the trip. Upon arrival at the Furnace Creek Ranch, after a very hard trip which would make a story of itself, the first thing I asked of Jim Dayton, who was the caretaker, was to show me the sacks of grain. He replied: "I can show you the 180 sacks, but there ain't no grain." Thinking he had sold it, I was very indignant and asked: "What has come of it?" He said the rats had taken every kernel of it. Going to the warehouse I found the 180 bags and a pile of sticks and stones and other curious articles which the rats had left in exchange for the grain.

I realized at once that this presented a very serious situation. We had to take the team and wagons clear back to Nevada. It was in the middle of summer and the heat was terrific, and we had only baled alfalfa for the team to eat. However, the situation had to be faced. We loaded the wagons, a front wagon and a trailer, with such articles as I thought the most valuable for us at the Nevada ranch. Then we baled alfalfa with a hand press, with the thermometer at 136 in the shade.

One of the men with me was Phil Horton, as a companion and not as a laborer. I told him it was very important that we should see that the men got back to civilization safely; that they should go along with the big team and we would give them practically all of our provisions, taking a very small amount for ourselves, and with the spring wagon and two horses and a saddle horse make a short

cut to Nevada. If any one was to perish on the trip it would be he or I; if any member of the party should not get out and we did, they would always say that we had taken the best of it and that the other poor devils had to perish.

Horton and I went out by way of Daylight Springs, Last Water, Thorpe's Well (now Bonnie Claire), Tule Canyon, etc., and succeeded in getting out with considerable suffering. The men with the big team went out by way of Salt Creek, Mesquite Flat, Steininger's Ranch, Lida Valley. However, they could not take the wagons further than the sand in Mesquite Flat. The horses, having only alfalfa to eat, lost strength in the terrific heat, and could not pull both wagons. Hence they uncoupled the back action and left it there.

This is the history of that "lost wagon." Desert Arabs from time to time helped themselves to the contents of the wagon, until everything had disappeared.

The place where the wagon was left and which is on today's maps as Lost Wagons is about twenty miles northwesterly from Stovepipe Wells, more than that from the course taken by the emigrants, and more than forty miles from Furnace Creek. Stretch's articles (quoted in the chapter on historical data) refer to Lost Wagons as being (inferentially) less than twenty-five miles from Furnace Creek. The exploration parties which entered or left Death Valley through Towne's Pass saw the abandoned camp called Lost Wagons somewhere near Salt Creek.

Manly tells of locating the Bennetts in camp at Furnace Creek, then going on, that day, to where the Jayhawkers were burning their wagons. Hardy traveler though the old pioneer was, he could not have crossed the Funerals and gone on to where the maps now put Lost Wagons all in one short winter day. It was enough for him to go as far as Salt Creek, in which vicinity the historic Lost Wagons was undoubtedly located.

Though bordered by rough mountain ranges, the Valley is accessible through a comparatively large number of passes, none of which, except the now unused Titus Canyon, offered special engineering difficulties. The writer has entered it by automobile through nine different ones,

most of them so light in grade as to seem natural roadways. Of the number of Indian trails there is no count; doubtless some showed the way for later road builders while others took steeper routes over the summits. The Eichbaum toll road follows the course of an old trail.

Eichbaum's toll road was the most costly in construction among all that reach the Valley. It was built from the eastern foot of Darwin Wash, to a gap in the Panamints westerly from Wildrose and enters the Valley by the route that the emigrants took in coming out, the Towne's (sometimes miscalled Townsend) Pass. This toll road has been bought by the state and is incorporated into its highway system and that of the National Park Service. It is of course a free road and is being brought to a higher standard. When this is written, plans have been completed for early construction of a new link between this route and Owens Valley, eliminating a few miles of distance and the ups and downs of Darwin Wash. Emigrant Springs is to the east of this road, which is now used to the almost complete exclusion of the old and unimproved county road over the same general course, but reaching the same valley inlet via Wildrose Canyon.

Had Manly led his party farther south in leaving Death Valley, he would have found a much easier exit than the canyon trail he followed. Wingate Pass (a modern renaming of Windy Gap, as it was called in borax-freighting days) rounds the south end of the Panamints into Death Valley. It is sandy, sometimes cut by washes, and used principally from the point where the road from Barstow joins the one from Panamint Valley. This route has some interesting features but as many drawbacks.

Goler Wash, a hitherto little-known route, lies between Telescope Peak and Wingate Pass. It starts as a deep slash in the Panamints, fifteen miles south of Ballarat. It is little improved, and has the possibility of being blocked by stones falling from either side of the narrow, winding way. A

few miles from its entrance it opens into the high area known as Butte Valley. Therein is found the isolated pyramidal height called by explorer McCormack "Curious Butte" and now known as Striped Butte. This is composed in part of almost vertical, narrow stratifications of contrasting bluish-gray and yellow. This route, thirty-two and one-half miles between the Panamint and Death Valley highways, has a good water supply at historic Anvil Springs.

A good desert road from Shoshone enters at the southeastern corner of the Valley via Bradbury and Jubilee passes and joins the one from Death Valley Junction in Furnace Creek Wash. This was the route to now deserted Greenwater. Dante's View is reached by a side trip from it.

Most historic among the entryways is that from Death Valley Junction through Furnace Creek Wash. The emigrants found there no such traveling as is now available for the motorist, for powder and manual labor have smoothed a way through an uneven and bowlder-strewn gap. This is the route followed by sight-seeing motor buses and most private cars.

Boundary Canyon, giving ingress from Beatty, Nevada, was one of the earliest known passes. For the most part, it is a natural roadway. Travel through it may turn south to Furnace Creek Ranch or continue west to Stovepipe Wells Hotel, branching northerly to reach Stovepipe Wells, over three miles of road which on our last trip were discouragingly rough because of washes.

A route entering the northern section of Death Valley through Grapevine Canyon and past Scotty's Castle leaves the Nevada highway at Bonnie Claire. It offers the somewhat unusual experience, on entering from the east, of driving into the mountains on a downhill slope most of the way. The elevation of the desert plain at Bonnie Claire is approximately 4,000 feet, while the trip through Grapevine Canyon is a descent toward the Death Valley level.

The northernmost entry now commonly used leads into the Valley by way of Sand Springs over the most open approach of them all. Here the Valley rises toward a gradual opening out into the general desert. At this time, however, the old road is sandy and may be cut by washes.

Between the Grapevine Canyon and Boundary Canyon roads is another, a relic of the short-lived mining boom at Leadfield. Much money was spent in building to that camp from Beatty a road with more variations of grade and more turns and twists than the combined total of all others around Death Valley. Leadfield, near the summit of the Grapevines, is at the head of Titus Canyon, a natural gash leading down to the Valley. The canyon is sandy and rather steep, and no one has now any interest in maintaining a road there. At last accounts it was passable as a descent but difficult for an up trip. The canyon, with its high and vertical walls, would be a fatal locality for anyone caught there by a cloudburst such as sometimes tears up the face of Nature in that region.

Proclamation by President Hoover, issued February 3, 1933, created Death Valley National Monument. Its southern boundary begins at the San Bernardino base line; runs easterly on the county line, northerly about 2½ miles west of Bradbury Well and, with unimportant offsets, to the state line east of Cow Creek, on the state line to about 2½ miles north of Scotty's Castle, west to the Last Chance Range, south across Ubehebe Peak; thence meanders along the summits, generally, across Telescope Peak and on to the starting-point. The inclosed area is under the superintendency of Colonel John R. White, whose able attention will doubtless add to the Valley's popularity.

Direct supervision is in the hands of his assistant, Mr. T. R. Goodwin. Official control has brought much improvement of roads and water-places, by the labor of the CCC (Civilian Conservation Corps). Two companies, from Ohio and Kentucky, were the first, arriving in October

1933 and remaining until the following May. Two New York companies spent the next winter at the headquarters established on Cow Creek. In April 1936 a new camp was established in Wildrose Canyon, on the flank of Telescope Peak, and occupied by a California company. In the autumn that company moved to Cow Creek, with another company of Californians.

These young men have done much toward the safety and pleasure of travel in that region. They have built more than three hundred miles of good highways, of which sixty miles have been oiled. It is expected that ninety miles more of oiled roads will be added during the coming season. Another of their accomplishments is the Telescope Peak trail, said to be one of the most outstanding in the whole National Park system. Beginning at the head of the automobile road in Wildrose Canyon, at 7,800 feet elevation, it climbs to the summit by easy grades, revealing magnificent views at many points, and at the topmost height unfolding an unsurpassed panorama.

Reverting to the subject of geographical designations: No name is more closely identified with the tragic history of Death Valley than that of William Lewis Manly. He probably named the Valley; he struggled and suffered as one of those who first traversed it; but for him many more would have perished; and he above all others kept that dismal record for posterity. Yet for many years not a landmark, not even a miserable waterhole bore his name. In 1929 an elevation in Golden Canyon was named Manly Pinnacle. With that inadequate recognition the matter rested until after the Park Service took over the administration. Colonel John R. White, superintendent, and Mr. T. R. Goodwin, assistant, gave attention to correcting misnamings. They proposed that the highest Panamint peaks neighboring Telescope to the north and south be called respectively Manly and Rogers. It is hoped that in time they will be so marked on official maps.

II. THE 'FORTY-NINERS

Spaniards or Mexicans were undoubtedly the first people other than Indians to visit the Death Valley region. The evidence of Frémont is conclusive that the route known as "the old Spanish trail" was used in travel between Santa Fe and California. Roundabout as it seems, it offered less difficulties than those encountered on the deserts farther south, including those of southern Arizona and half the width of California. Frémont, on the route in 1844, was careful to select the encampments used by Santa Fe caravans, he says. He noted that "the line of our road was marked by the skeletons of horses, which were strewed to considerable breadth over the plain," and tells of reaching "a large creek of salt and bitter water. It is called by the Spaniards Amargosa—the bitter water of the desert. Where we struck it the stream bends."

While the Pathfinder's march was past and not into Death Valley, his description makes clear that the Mexicans knew of that general region; and, as will later appear, they did some early mining in the Amargosa neighborhood. This leads to the belief that they, and not the Mormons, built the furnaces which gave the name to Furnace Creek, a belief supported by Mormon church records.

The first definite record of Death Valley begins with the emigrants who wandered into it toward the close of the year 1849, on their way to the gold fields of California.

By common acceptance the term "Jayhawkers" has been most frequently used to designate that expedition and is so employed in some of the records left by survivors. Their detailed accounts, however, prove that its use was merely for convenience and that the name properly belonged to only a small group. Others, including many whose experiences were the most tragic, were not then recognized as part of the Jayhawker organization, being connected with it only as fellow-travelers.

The expedition included a number of different parties, each with its own story but all belonging in any résumé. The best record is found in *Death Valley in '49,* published in 1894 by W. L. Manly. It was the authority most used in an attempt to sum up the subject in *The Story of Inyo.* Manly, in his desire to make his story complete, goes back and forth over the ground to a somewhat confusing degree. The account by L. Dow Stephens, *Life Sketches of a Jayhawker of '49,* touches but too briefly on matters of special interest in this narrative. "The Death Valley Party," a series of articles by J. W. Brier, published in *Out West* in 1903, is by one who was only six years old in 1849 and whose recollections were necessarily mostly second-hand. Recollections of Mrs. Brier, published in the *Stockton Independent* (1913), interviews with Thomas Shannon (*San Jose Mercury,* 1903) and J. B. Colton (*San Francisco Bulletin,* 1903) are of value, but comparatively brief. The experiences of Edward Coker and Alexander Erkson are included in Manly's volume. Those of P. A. Chalfant relate to only the early part of the journey, as his subdivision, the "San Francisco party," branched off in western Utah and escaped the main perils.

There are so many contradictions in the stories that only general outlines on which all agree can be accepted as positively correct. Differences in experiences as well as in points of view account for some of the variations; the fact that the accounts were written forty years or more after the events increases the number of variations. The terrain traversed remains even today poorly known, and the absence of geographical names and of notations proving the directions of routes taken adds to the difficulty of mapping them. A painstaking comparison of topographical maps with the emigrant descriptions helps but little.

Colton tells us that a child of Mrs. Brier's is buried in the mineral beds of Death Valley. No other narrative mentions this. It may be assumed that if it were true the fact

would not have been ignored by Mrs. Brier or her son. The accounts do not agree as to the number who perished; and there are other differences, some of which will be indicated here.

The airline distance between Little Salt Lake, initial point of hardships of the journey, and Death Valley is about two hundred and forty miles. Wanderings and deviations increased this, probably to much over three hundred; and when Death Valley had been passed, there remained two hundred or more miles before the emigrants reached succor.

The experience was during the coolest and most favorable season of the year. In the hotter months, probably none of the party would have lived long enough to reach Death Valley, for the forbidding deserts farther east would have destroyed them, unsuited as the caravans were for such a journey.

And now the story.

News of California's riches led to the formation of a band of adventurous young men, residents of Galena, Knoxville, and other towns in Illinois, in the spring of 1849. The company left Galesburg on April 5 (Shannon) or March 28 (Stephens). A formal organization was made at the Missouri River, says Manly, after a guide had so advised. The men were allotted to divisions, one of which was headed by Ed Doty. When Doty was elected captain he was carried around camp on the shoulders of some of the men and introduced as "Kingbird of the Jayhawkers." Hence the name given to the whole company. Rough ceremonies of initiation were employed, as a means of camp amusement.

It was a gay adventure for those youths for many days. Though they began by setting guards, lack of disturbance led to the pickets occasionally coming into camp and sleeping through the night. One morning the campers found that every ox had disappeared. They saw two trains across

the Platte River, one a mile in advance of the other. Some of the Jayhawkers crossed over, but found nothing suspicious in the nearer camp. Its occupants expressed a poor opinion of the outfit ahead, with which they said they had refused to travel. The Jayhawkers, barefooted, and clad in overalls and shirts, hurried on, halted the moving train, and after some heated argument recovered their oxen, seventy head. Thereafter they were more vigilant.

They found many other travelers at Salt Lake City. One of the trains was the San Francisco party of forty-five wagons. It had been formally organized in military fashion. There was also a "Hawkeye" train of Iowa people; the Georgians, and another company, one led by Townshend, one by Towne; but how many other companies, large or small, the record does not show. The emigrants stayed in Salt Lake through the summer, buying oxen and provisions and otherwise meeting such needs as could be foreseen.

About the first of October (October 3, according to Manly and Shannon; September 30, Brier) the trains pulled out for California. The story of the Donner party which had met disaster in the Sierra near Tahoe caused the selection of a southern route, a choice encouraged by the Mormons, who wanted the way opened to their San Bernardino outpost. After leaving Salt Lake the caravan was joined by a new train of seven wagons, a company which was to contribute more than any other to the tragic story of Death Valley. This party contained Asabel and Sarah Bennett and their three children, J. B. Arcane and young son, two Earhart brothers, an Earhart son, drivers Abbott and Helmer, William Lewis Manly (a Wisconsin neighbor of Bennett's), John Rogers, and two or three others.

A point south of Salt Lake was chosen as a rendezvous before starting across the great desert. This was at Provo (Colton, Stephens), a hundred miles south of the lake (Manly). Here the train of wagons (107, Manly; 105,

Stephens; or 112, Mrs. Brier) was made into seven divisions, which were known by numbers (Manly) or by fanciful designations (Stephens) such as "Hawkeyes," "Jayhawkers," "Buckskins," "Bug Smashers," "Wolverenes," and so forth. Arrangements for guidance had been made with a Mormon elder, Captain Hunt—given name Jefferson, according to Mormon church records, though Colton calls him Juan and Manly names him John. He was to take the train through on the "old Spanish trail" to southern California for $10 per wagon or $1,000 for all (Manly) or $12 per wagon (Mrs. Brier). Hunt had been leader of a company in the Mormon battalion, serving in the Mexican War. On their way back to Salt Lake the remnant of that battalion had driven a band of cattle as directly as they could from southern California, hence Hunt's knowledge of the route.

A written agreement organizing the "Sandwalking Company" was drawn up and generally signed. It does not appear, however, to have dealt with the important detail of route, doubtless leaving that wholly to Captain Hunt. The caravan proceeded to Little Salt Lake, in southwestern Utah.

While in Salt Lake City the Jayhawkers had been told about a route which it was claimed would cut off five hundred miles of travel, and a map of it was made by a man named Williams. This cut-off, referred to as the "Williams short route," had been much discussed. An independent train commanded by a Captain Smith came to the Little Salt Lake camp, and Smith had a map similar to the one furnished by Williams (Manly). Mrs. Brier says it was a Frémont map; Stephens says its author was Barney Ward. J. W. Brier says it was made under direction of Chief Walker, a friendly Indian. Smith and his men went on, presumably to safety, for we find no other mention of them.

This chance meeting at Little Salt Lake led to later

misfortune. There was already some sentiment in favor of the Williams short cut on the part of the Jayhawker subdivision, and Smith's arguments added to the discord. Hunt expressed strong doubt that any white man had ever been over the cut-off. If the whole train decided to adopt it, he would accept the decision; but if even a single driver chose to stick to the original route, he advised he would feel in duty bound to go that way.

The country became more and more barren as the train went forward. A narrow valley was traversed, and in it were found so many "long-eared rabbits" that five hundred were killed, giving a greatly appreciated stock of fresh meat. Ere long the leaders came to the place where Smith had started on the cut-off. "It was really a serious matter," wrote Manly. "Team after team turned to the right, while now and then one would keep straight ahead as first intended. Captain Hunt came over to the larger party after the decision was made and wished them all a hearty farewell and a pleasant journey. My friend Bennett, whose fortunes I shared, was among the seceders who followed the Smith party. This point where our paths diverged was very near the place afterward made notorious as Mountain Meadows."

After three days' travel, the larger party came to a canyon that seemed impassable, and all but twenty-seven wagons turned back to the Hunt route. The others found a way around the gorge, and after leaving that place, called Poverty Point by some of the writers, none went back. There were minor divergences of route, many of them, by different small parties, as the days passed; but nearly all came together at the eastern edge of Death Valley or arrived there at about the same time.

The San Francisco party was one exception. It stayed on a more northerly course and reached northern California through Beckwith or Beckwourth Pass without mishap. Reverend Mr. Brier and his family, who had

Photo by Frasher

At Furnace Creek Ranch

Photo by Frasher

Furnace Creek Wash

been with this branch most of the way into Utah, chose to take up with the Jayhawkers instead. The latter did not approve the suggestion, deciding that no women or children were wanted with them. Brier refused to accept this decree, and though traveling more or less independently he stuck substantially to the Jayhawker trail. His son's account indicates that for a time the Briers attached themselves to the Georgians.

Bennett and Manly made no protest, and, although they were somewhat in touch with the Jayhawkers at times, their seven wagons were handled as an independent train. Manly's narrative indicates that twenty wagons were with the Jayhawkers; Stephens says: "When we left Salt Lake we had two teams of four oxen to each and only eight men."

That part of the train piloted by Hunt, probably about eighty wagons after the Poverty Point split-up, had no easy journey, it may well be assumed. Like the Jayhawkers and others, its course was over barren deserts, volcanic, hill-strewn, sun-parched, its slow progress accompanied by a constant cloud of dust from sands never before disturbed by wheels. Scarcity of water, shortage of provisions, and total absence of wild game or other procurable supplies to improve the diminishing larders were the daily experience. But each day's journey was to some extent foreknown. Hunt blundered once in his route, adding a few days to the time of travel; otherwise there was no misfortune. Water scarcity was anticipated and replenishment points were known. We see that train, its cumbersome and crawling vehicles more plainly marking the Spanish trail, reach welcome Resting Springs, where the clear outpour was later to irrigate a 200-acre ranch, and where there was in 1849 abundant natural meadow on which the jaded cattle could gain fresh strength for the long trip still ahead. We see them leave that oasis with fresh energy, and in due course reach the green vales of

southern California, in safety, as Mormon records establish. And so with the emigrants who were not too wise in their own conceit we are done.

Extracts from diaries and other writings indicate the daily trials of the unfortunates yet on the desert. Colton tells us his party was for fifty-two days practically without food. Manly tells some of the story in these sentences:

> On the third morning a lone traveler with a small wagon and one yoke of oxen died. He was from Kentucky; I have forgotten his name.
>
> As I had no team to drive I took every opportunity to climb the mountains along the route . . . . and was thus able to see all there was of the country. . . . . I climbed a high butte which was about 20 miles south of our route. It seemed as if pretty near all creation was in sight. North and west was a level plain, fully 100 miles wide it seemed, and from anything I could see it would not afford a traveler a single drink in the whole distance or give a poor ox many mouthfuls of grass.
>
> At camp we had only the water in our kegs. . . . . The boys found some rainwater in a basin in the rocks and took a good drink. West swallowed all he could hold and then told the boys to kill him, for he would never feel so good again. They drained the pool, it was so small, before they left it.
>
> The mountains and valleys grew more barren and water more scarce all the time. When found the water would be in holes at the outlet of some canyon. There were no trees, no fertile valleys, nor anything green.
>
> Our road had been winding around among the buttes, which looked like Indian baskets turned upside down on the great barren plain. There were dry lake beds scattered all over the plain. All the lakes appeared about the same, the bed white and glistening in the sun, and so hard that a man passing over it made no visible track. It looked as if it at one time might have been a smooth bed of plastic mortar and had hardened in the sun.
>
> Our oxen began to look bad. Grass had been very scarce, and when we unyoked them and turned them out they did not look around much for something to eat. Though fat and slick when we left Salt Lake they now looked gaunt and poor and dragged themselves slowly along.

The main facts were common to all subdivisions: The

crawling ox teams, their few miles of daily progress gradually lessening as the animals weakened from lack of nourishment and of water; playa lakes (level areas which are catch basins for storm waters but which soon dry to sun-baked surfaces), the deceptions of which the travelers learned to disregard; treeless hills or short mountain ranges, to be skirted or crossed; barren plains and valleys, offering not a spray of genuine verdure, and even little of dry desert vegetation; lessening stocks of supplies, and growth of despair; all this day after day, week after week.

The Jayhawkers went five days without finding water and their containers were empty when the skies clouded and a light fall of snow came down, to be caught on blankets or in any way to save it for quenching the thirst of men and animals. More waterless days passed before they reached the Amargosa River, then at a low stage. Its mineral-charged trickle satisfied their thirst but brought illness to every being that drank it.

The same storm providentially saved the Briers, then at a branch of Forty-Mile Canyon, where they stayed for a week. Before leaving they burned their wagons and loaded necessities on the oxen. "It was a fatal mistake," wrote Mrs. Brier, "as we were about 500 miles from Los Angeles and had only our feet to take us there."

An interesting contribution to the literature of the journey is the diary of Captain Asa Haines, which is, or was, in the possession of his grandson, a resident of Long Beach. Its terse entries, written in pencil, have become almost undecipherable during the passing years, but such as could be read told a graphic story:

East 4 mile, layed by; thence south 28 mile, no water, 10 o'clock at night.
Thence west 10 mile, no water.
Thence south 12 mile, no water.
Thence southeast 8 miles, got weak.
Thence due south 20 mile, no water.
Left wagons, packed cattle, six days wandering.

Stayed in canyon three days. Indians stole horses, all but two.

18 miles southwest, no water, one death, Fish from Iowa, starvation. Williams Ischam died same day in evening.

These deaths are located by Manly as occurring after passing Death Valley, probably in what is now known as the Slate range. Haines's diary continues:

William Robinson and McGowan got through desert but died at foot of mountains. Frank, a Frenchman, wandered off. [This Frank was found ten years later living with Indians.]

Offered Brian Byron $5 for a biscuit but he refused. Old man Townshend left. Bill Rude and Dow Stephens bake flour and offer me food.

Luther Richards found water; snowed same night. One man laid down. Made coffee, went back and he was dead.

Find body of Townshend; scalped.

This would appear to be definite information as to Townshend's fate, but Manly asserts that Townshend and the Georgians crossed Walker's Pass and that all but two were killed by Indians on the Chowchilla River, west of the Sierra. A further reference to this party will appear later in this record.

Manly and his party, still east of Death Valley, found a place where Indians had raised a sort of crop, including a vegetable termed a squash by Manly but supposed to be the gourd-like growth known as the desert apple or coyote melon. During Manly's scouting absence his comrades robbed the scanty garden and in revenge the natives made an attack and shot arrows into three oxen. One was so badly wounded that it was killed to save its scanty flesh. The emaciated animals, then as later, yielded meat that under ordinary circumstances would have been revolting, and the bones contained instead of marrow only a bloody slime.

Colton wrote: "Sometimes we would find a big lizard or chahwalla and sometimes a little desert turtle, and we eat up all the snakes and ravens we could catch." Which were probably very few.

In cavities in cliffs the Manly party found

balls of a glistening substance looking like pieces of variegated candy stuck together. The balls were as large as small pumpkins. It was evidently food of some sort and we found it sweet but sickish, and those who were so hungry as to break up one of the balls and divide it among the others, making a good meal of it, were a little troubled with nausea afterward.

An old Indian told R. J. Fairbanks, pioneer of that region, of an attack by tribesmen on a party of whites in the lower foothills of the Funeral range. He said the white men had burned their wagons at that place. Dane Coolidge, author, visited the scene and picked up a quantity of rusted pieces of iron (which the writer saw), evidently relics of such an occurrence. Among them were hub caps with holes for linchpins such as were used at that period. The story is current that someone in the expedition was a jeweler, carrying some of his trade stock with him, and that he buried the lot in the sand before abandoning the camp. It must have seemed improbable that he would ever return to recover it, even if he finished the journey he was then making. However, more than one searching party has gone to the place to try to rediscover the buried treasure, but with no such success as that of Mr. Coolidge with his wagon irons.

Which of the subdivisions burned one or more wagons at that point is not stated by accounts available. It was not the Manly party. Brier's wagons were driven over the dunes, his son wrote. Manly says the Jayhawkers abandoned their wagons in Death Valley; that it was at or near Salt Creek is a reasonable certainty. Manly mentions a company headed by a man named Martin, which came to the Furnace Creek camp "in light marching order," and this was probably the wagon-burning party at the base of the Funerals.

Seemingly the Georgians were first to enter Death Val-

ley. Somewhere back on the route they had joined with and later separated from the Jayhawkers, and they appear to have crossed the Funerals somewhere to the north of Furnace Creek. Towne Pass is one of the western entries into Death Valley. Easterly from it is Emigrant Pass, so named many years ago, through which it is supposed some of the 'Forty-niners made their way. There is discrepancy in the spelling and also in the accounts of Haines and Manly regarding Townshend. No other Townshend or Townsend appears in any account, though the name Towne does appear and was known to white visitors there ten years later.

Brier's account says: "Nearly opposite our encampment a train mounted to an elevation of the Panamint range, where a valley rich in grass afforded an easy descent to Wildrose and Darwin canyons." This valley is supposed to be that now known as Harrisburg Flat, which bore a fairly abundant growth of grass up to about fifteen years ago.

One of the members of Martin's party, before mentioned, was Edward Coker, from whose brief narration we learn that this division made its way out via Owens Lake, reaching that body of water in a snowstorm. "Our journey through the mountains was full of adventure and suffering. On our arrival at the shores of Owens Lake not a man of the party had a mouthful of food left in his pack." They had several encounters with hostile Indians, but were directed by a friendly native to follow the "Frémont trail" (probably made by Walker in 1845). It took them through Walker's Pass, to the south fork of Kern River, and into the San Joaquin Valley a few miles south of where Porterville now is. None of this party died on the trip, but Coker asserts that it was into their camp that Ischam wandered and breathed his last. He was one of four members of an independent party, only one of whom, a negro, got through alive.

Brier tells of another small party:

> Eleven young men had "packed their backs" soon after we left Captain Hunt. At the Amargosa they separated, Savage and Pinney steering for the White mountains and the nine crossing Funeral mountains and entering Death Valley. Savage and Pinney were found by Indians, who gave them food and conducted them as captives to Owens Lake. Pinney delighted the Indians by his dancing, his great size, and the redness of his hair. They called him "Big Chief" and in the spring led him and his friend to the inland plain. The skeletons of those who entered Death Valley were discovered some years after.

This agrees with brief mentions by both Manly and Stephens.

A Mr. Wade and family, who camped near the Bennett party but apparently had no association with them, are mentioned by Manly, without information as to how they ultimately fared.

This is the substance of knowledge of parties other than the Jayhawkers and the Manly-Bennett party, whose experiences we shall again take up.

Reaching the Amargosa River, the Jayhawkers bore north of westerly toward a pass they could see. It was uphill and rough going, made harder by the weakened condition of men and animals, increased by indulgence in the river water. On the second night they were on the east slope of the Funerals, having lost an ox in making the ascent; and on the third day they made their way down the pass (Furnace Creek Wash) and camped at Furnace Creek, where they found palatable water and some coarse vegetation that the oxen could eat.

Manly, scouting ahead of his party, struck the trail the Jayhawkers had made, and followed it through the pass into Death Valley. He came upon the ox the Jayhawkers had left; a gash had been cut in its thigh, and the sun had dried the meat clear to the bone. He cut out a chunk of this and ate it as he walked. He came upon the

Briers in camp at Furnace Creek, and says that he recollects it as being Christmas Day. He found Brier delivering a lecture on education to his sons, aged four, six, and nine years. He avers: "I inquired for others of the party and was told that they were somewhere ahead."

Stephens' account inferentially locates the Jayhawkers far to the east of Death Valley on Christmas Day, but Mrs. Brier supports Manly by saying that "on Christmas day we came to a small stream" (Furnace Creek). J. W. Brier says that the Jayhawkers and his family entered Death Valley together at midnight, December 24. Concerning the lecture, he indicates a larger audience than Manly mentions: "The men wanted something to remind them of other days, and my father gave them a lecture on education."

After getting the Bennetts in camp at Furnace Creek, Manly walked on, and at dark came to the campfire of Doty and his Jayhawkers. The latter had decided to kill the weakest of their oxen, and were at that time burning their wagons for heat by which to dry the meat. This was at the real Lost Wagons of Death Valley history, near Salt Creek. He spent the night with the Jayhawkers, and on the way back to Furnace Creek the next morning met Gould and Fish, two men who had been with his wagons but who had decided to strike out for themselves.

We now follow the Jayhawkers to the end of their part in this story. Brier writes:

> We passed into Death Valley along the margin of a coruscating basin of salt and soda. That day we overtook the Jayhawkers; and as our own company had been reduced to a small fraction by the departure of Captain Towne and party we united our fortunes with theirs. They endeavored to persuade us to remain at the springs, promising to return from California to our rescue. My mother, who had never been a burden to any one, heroically refused, and the Jayhawkers gallantly pledged her undivided loyalty. [Stephens says: "Rev. J. W. Brier and family came up to us and wanted to travel with us. At first we objected, but hadn't the heart to refuse."]

Photo by John L. Von Blon

Natural Bridge

Steering north of west we drove across the shifting dunes for twenty miles to the pass between the Panamints and Telescope Peak [Brier's direction is at fault here], from the summit of which we were in plain view of Mt. Whitney and the Minarets. We were only two days' journey from Owens Lake; but we turned to the south and prolonged our journey by hundreds of miles. All this I can distinctly and accurately recall. Twenty miles across the sand dunes, the wind driving the sand like shot into the face and eyes; a raging thirst, for we had found no potable water in the Valley of Death; the bench lands, thickly strewn with basalt boulders; the snow line, to which my father mounted, returning with all the snow he could carry, which we melted for man and beast; the field of snow that we crossed, the cattle eating it to assuage their thirst; the majestic view of Mt. Whitney and the Minarets; the midnight march down the long and irregular canyon; the arrival at an Indian village among the mesquite groves, in which only one of the villagers remained, an aged squaw, who scolded us in a language we did not understand. Midway of this village was a vast heap of offal, and the bones of horses were scattered about freely, showing that the natives were accustomed to cross the great range of California for their regular supply of meat. .... The few left of our original party baked up the flour that was left to them, and with many regrets left us. We had beef—such as it was—in plenty, but no bread.

Doty and his men crossed Panamint Valley, past an alkaline lake, to and over a pass into the Searles Lake basin. Ischam and Fish died on this route. Manly and Colton give the understanding that Ischam died while descending the slope toward Searles Lake. Mrs. Brier said that he had fallen behind and crawled four miles on his hands and knees before he died. The Briers, who had been left in the Indian village, came up with the Jayhawkers the second night after crossing the Panamints.

The sufferers moved on across the plain for at least four days, if not five, before finding water. Death from thirst and starvation for all seemed as imminent then as it had at any time before, and one man, William Robinson, died before the trip ended. The oxen were killed one by one, and every possible portion of the animals, hide and intestines included, became food. On February 4, 1850,

after three months spent on "the Great American Desert," as it was designated in the geographies for many years, the Jayhawkers reached living streams and grass country. Their first meal of wholesome, even though unusual, food was made from the flesh of three horses they shot. Vaqueros came to them, and on learning their plight took them to the San Francisquito Ranch, owned by the Del Valle family of Los Angeles. They were given the best of care, and in due time scattered to various parts of California or returned to their eastern homes.

No story of that ill-fated expedition is complete without recognition of the heroism of Mrs. Brier. Manly and Colton, especially, give very unfavorable impressions of her husband. Every mention of her includes words of the highest praise; that her husband and sons survived was solely due to her courage and fortitude, according to the accounts. Here are extracts from her own story of the ordeal:

> Poor little Kirk, my eldest boy, aged nine years, gave out, and I carried him on my back, hardly seeing where I was going, until he would say, "Mother, I can walk now." Poor little fellow! He would stumble on over the salty marsh for a time and then sink down again, crying, "I can't go any farther!" and then I would carry him again. Many times I thought I would faint, as my strength would leave me, and I would stumble to my knees. The little ones would beg piteously for a drop of water, but we had none to give them. . . . . Many times when night came my husband would be on ahead looking for water, and I would search, on my hands and knees, in the starlight for the tracks of the oxen. . . . . The men killed an ox for our Christmas, but its flesh was more like poisonous slime than meat. There was not a particle of fat on the bones, but we boiled the hide and hoofs for what nutriment they might contain. We also cooked and ate the little blood there was in the carcass. I had one small biscuit, but we had plenty of coffee, and I think it was that which kept us alive.

To the Jayhawkers, the Briers, and others who passed through Death Valley hurriedly and who spent two or not more than three days there, the place was hardly more than an incident in their many weeks of misery. It was not

more cruel to them than the rest of the desert had been or was afterward. The real story of "Death Valley in '49" is that of the Bennett-Manly subdivision, or independent party, which remained there four weeks.

The Bennett-Manly party was at Furnace Creek when the Jayhawkers were burning their wagons at Salt Creek. Those in this seven-wagon detachment have been named earlier in this chapter, except Captain Culverwell, who had left another band and joined them.

Bennett and Arcane concluded not to wait for Manly to go ahead and scout out a way, and they decided against following the route taken by the Jayhawkers from that point; so, according to Manly,

> They hitched up and rolled down the canyon and out into the valley and then turned due south. We had not gone far on this course before we saw that we must cross the valley and get over to the west side. To do this we must cross through some water. I rolled up my pants, pulled off my moccasins, and waded in, having the teams stand still till I could find out whether it was safe for them to follow or not.
>
> The water was very clear and the bottom seemed uneven, there being some deep holes. Striking my stick on the bottom it seemed solid as a rock, and breaking off a small projecting point I found it to be solid rock salt. It looked to me as if the whole valley might have been a solid bed of rock salt.
>
> The second night we found a good spring of fresh water coming out from the bottom of the snow peak almost over our heads. The small flow from it spread out over the sand and sank in a very short distance, and there was some quite good grass growing around.

The desperate situation of the party was discussed until a late hour that night. The next morning four men, Helmer and Abbott, who were Bennett's drivers, and the two Arcane drivers, decided to take their share of provisions and strike out for themselves, which they did, to find the Jayhawker trail.

The wagons went on about eight miles and came to the mouth of a rocky canyon leading into the Panamints. A

little spring of sulphur water in a mound of sand was found, and a man was kept by it all night to dip out the scanty flow in order to collect enough for the camp and the oxen. A day was spent in traveling up the canyon, and in returning when it was found that the wagons could not get across and that neither water nor grass was to be had. That night by the sulphur water hole another council was held. The few small pieces of dry bread were kept to be fed bit by bit to the children; for their elders there was but the repulsive flesh of the cattle. Bennett proposed that two of the youngest and strongest men be sent out to reach a settlement, while the rest returned to the good spring to await their return. Manly and Rogers were chosen to make the trip. An ox was killed, and seven-eighths of its meat was put into the knapsacks of the two couriers. This with a couple of spoonfuls of rice and as much tea was their provision for the unknown journey.

They crossed a gap south of Telescope Peak, staying on the mountain that night. They descended to the pool in Panamint Valley, only to find its brine a literally bitter disappointment. On the next range they found the Jayhawker trail, and near it holes dug by that party in the vain hope of finding water. Near the summit they came upon the body of Fish, lying as he had fallen. He, it may be recalled, was one of the two Manly had met as he was returning to Furnace Creek from Lost Wagons.

Manly and Rogers found no drinkable water in the first two days of their traveling after leaving the Panamints, and the heat and their exertions made them desperate from thirst. At the end of the second night Rogers went up a little canyon, hunting for water, and at sunrise chanced upon a little ice, with which they filled a kettle. Manly records how providential the discovery was, for if they had not done the night traveling the sun's rays soon would have melted that glass-thin sheet of life-saving ice. The following night they saw a campfire, and reconnoitered

carefully before ascertaining that it was that of some of the Doty men. The next day they pushed on and overtook and passed the leaders of the Jayhawkers, and then the teamsters who had left the Bennett Wells camp. The two divided their scanty rations with their former camp mates, some of whom gave addresses of relatives, for they did not expect to finish the journey.

Ahead was a great open plain which they believed would take five or six days to cross and which seemed as waterless as the desolation they had traversed. But they set out again, and in a few hours came to a spring surrounded by willows. Going on, they found the bones of many horses along the trail. At the day's end they had reached the base of a mountain which gave them a clear view for many miles. Manly says that to the northwest was what is now known as Tehachapi Pass, to the south the San Bernardino Mountains. They had been out seven days. The second day thereafter they killed a crow, a hawk, and a quail and found a stream of good water. More travel, until (on New Year's Day, 1850, Manly says) Paradise opened before them in the form of a grassy meadow on which many cattle grazed. One of these was promptly slain, and they ate and slept and dried beef and rested. They reached the home of a Mexican family, were treated with the utmost kindness, and partly equipped for the return journey. At another camp they obtained more help, and when on the back track they reached Elizabeth Lake with three horses, a mule, a sack of beans, a small sack of wheat, some good dried meat, and some coarse flour. That night they reached the willow-walled spring, and made good time on the return journey but suffered for want of water. All three of the horses died or were abandoned before they reached a point where Manly and Rogers could look down into Death Valley. Twenty-five days after they had left Bennett Wells they camped again at the sulphur water hole.

The next morning they went on, but could not see the wagons plainly until within half a mile of the camp. There had been seven wagons; now only four were to be seen, and the covers had been stripped from them. What had happened? Had the Indians raided the party? Had the discouraged emigrants given up hope of the return of its messengers and struck out with three of the wagons?

The men approached the camp with the utmost caution, fearing that Indians might be lurking there. A hundred yards from the wagons not a sign of life was visible. Manly fired a shot from his rifle. After a moment a man came from under a wagon and looked around. At first he did not see Manly and Rogers; then he shouted, "The boys have come! The boys have come!"

Explanations were forthcoming. The unfortunates in camp had almost abandoned hope of rescue. Only the Bennett and Arcane families remained. Hardly were Manly and Rogers out of sight before discussion began. The other men seemed to hold that their first duty was to save themselves, and all but the two families were convinced that if the couriers ever got out safely they would be fools if they came back. No provisions were in sight but the gaunt oxen, and it would be but a little time until that resource would be exhausted. It would be better, they argued, to move on a little each day and thus get a little nearer the goal before the food was all gone. Within a week from Manly's departure men began to start out with their oxen. Culverwell had gone with the last such detachment; he had then turned back and had died on the trail.

Bennett had tried to convince the men that when their "forlorn hope" returned they would know more about the route and have a better chance to get out. But such arguments were unavailing, as were Bennett's pleas that the men should not leave them to become easy prey of Indians.

Even the faith of the Bennetts and the Arcanes had begun to weaken a week before, and they themselves had

begun to prepare to move on. Wagon covers had been stripped off to make housings so the oxen could be used as pack animals. Feathers had been emptied from bedding and the cloth used for the same purpose. Making the harness had not been finished when the couriers returned.

Can one imagine the joy in that despairing camp when Manly and Rogers reappeared? The occupants ran to meet them, the men embracing with all their strength, and Mrs. Bennett fell to her knees and clung to Manly like a maniac, he wrote. Not a word was spoken, and as they went on to the wagons convulsive weeping choked all utterance. When all had calmed somewhat, Manly told of the difficulties ahead, and that at least two hundred and fifty miles must be walked. Though they now knew what to expect, the outlook was dark indeed.

Bennett's little daughter Martha had been so ill that they had thought she would die, and there was little the anxious parents could do for her. She had recovered somewhat when Manly returned, though misshapen and little more than skin and bones.

Manly knew the route the Jayhawkers had taken to get through the Panamints. There was debate as to whether they had better try to go that way or across through the canyon traveled by Manly and Rogers. The former course would take several days longer, and it was decided to risk the roughness of the more direct route.

Two oxen were selected for the women to ride, and one for the four children; the mule was used to carry the pitifully scanty provisions. The oxen were obviously poor saddle animals; securing their harness so it would not slip off was a problem to meet. For carrying the children, a pair of strong hickory shirts were sewed together at the tails, the necks were sewed up, and the combination put astride the ox, with a child in each, serving as what the Californians called *"aparejos."* Those were for the younger children, while the two older were to ride on the animal's

back, holding to a band around its body. The remaining cattle were loaded with water kegs, blankets, a small tent, and other articles. Manly saw enough humor in the situation to observe that the oxen did not think they needed blankets, for they were afraid of their loads.

Everything not absolutely essential was left in the camp. Mrs. Arcane, city bred, took some of her articles of finery and put on her best hat. All selected their best garments to take with them.

The sun was high overhead, says Manly in his account, when the children were loaded on their steed, old Crump, and the women were helped to their places on the softest seats that could be made for them. The procession moved along satisfactorily for four miles. Then the pack on the lead ox got loose and he tried to kick it off. His foot caught in the harness and he bawled in terror, while the rest of the cattle caught the infection of fear. The oxen bucked off their loads, then became quiet. When the trouble began, Mrs. Bennett slipped down from her load, grabbed her baby from its pocket, shouted to the older children to jump, and so got her family to safety. Arcane took his young son from the other pocket. The ox ridden by Mrs. Arcane did like the others, jumping around and bawling, but the lady stayed with her mount for some time before being thrown off. No one was hurt, and the party enjoyed a good laugh—probably their first in many weeks.

This mishap and the late start necessitated making a dry camp at the spot. The next morning the oxen were again loaded, without much trouble, and the journey was resumed. The women decided they had had enough of riding and thereafter walked. Camp was made in the canyon that night, with the women so worn out and discouraged that they expressed doubts whether they could endure another such day. The second day they reached the summit, and there uttered the farewell which, we have no doubt, named Death Valley for all time.

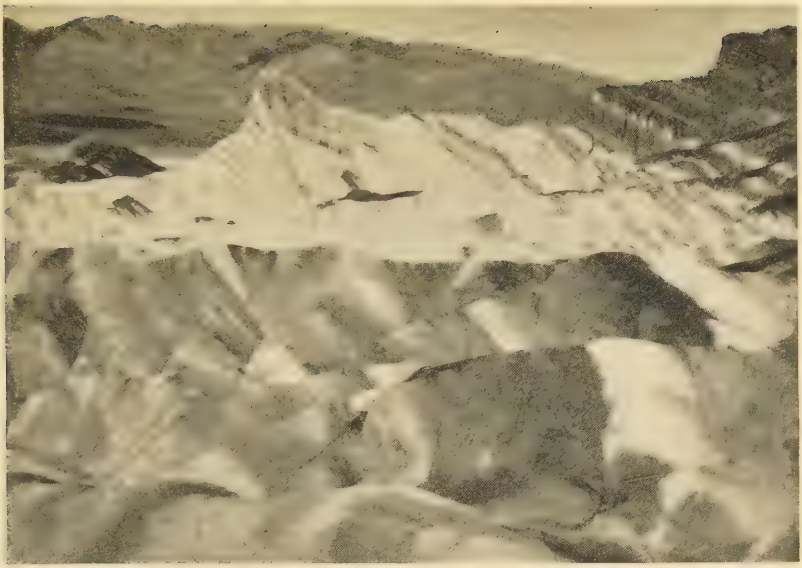

Photo by Padilla

Funeral Mountains near Zabriskie Point

Photo by Frasher

Northern arm looking across the sand dunes

To the east was the inferno they had crossed, and beyond it the barren Black and Funeral mountains. Ahead was Panamint Valley, no more inviting. Massive Telescope Peak loomed over them, eliciting from the men the observation that they had never supposed America contained such grand mountains.

That night's camp was at what Manly terms "the falls," a thirty-foot break in the canyon floor over which they had guided their tough little mule with some difficulty, and where two of their horses had been abandoned, exhausted. The difficulty of getting their oxen down over the falls had been the cause of their considering following the Jayhawker trail rather than try this route.

The men moved all the large stones away from the foot of the cliff, and piled up all the sand they could scrape together. Manly makes it clear that the harness was used to lower the loads. Then ropes were tied together to a length of thirty feet or more, and each ox was brought to the verge, with the rope tied to his horns. Manly stayed below with the other end of the rope, with instructions to keep each animal's neck stretched. Bennett and Arcane at the sides, and Rogers at the rear, gave a tremendous push at the word, while Manly pulled, and each ox sailed out into the air and landed safely. All the animals were thus brought down unhurt. The bodies of the two abandoned horses were found in the deep, narrow canyon.

The next day was most exhausting, and ended with a dry camp on a mountain side. The next camp, closing the fifth day from Bennett Wells, was at what the Jayhawkers named Providence Springs. Stephens says the springs still bear that name. It does not appear on any map investigated, however. Manly had buried his wheat at these springs on his journey into the Valley and now found it in good condition. An ox was killed here, and every particle of it saved for food.

In the next four days, all the food that Manly had

taken into Death Valley was used and some of the wheat he had cached and later resurrected was all the travelers had in the camp at the end of the ninth day's travel from Bennett Wells. A little farther on, the trail they followed came to a forking. As Manly says one branch turned through what is now known as Walker's Pass, their location was then in the vicinity now known as Freeman. Kern River could have been reached, had they turned into the pass, in less time than they used in getting where help could be found on the course to which they held, but they believed they would get into snow if they went that way. Another camp was made at the head of what Manly says is now called Red Canyon—probably Redrock. Here a two-inch fall of snow covered the ground. While the weaker members of the party were getting warm, Manly slaughtered an ox. The next camp was at a spring southeast of the mouth of the canyon.

On the twentieth day—let us pass over the intervening time, in which there was little relief from continual hardship and suffering—a small running stream was reached, and camp was made after crossing a snow field. Tracks of animals had been seen in the snow, and Manly and Rogers went back and killed two fat yearling cattle. Six of their eleven oxen had been killed since leaving Death Valley, the weakest and poorest each time. Now no more of the patient beasts were to be sacrificed to save the lives of the human beings they had so faithfully served. Three days later, on March 7, 1850, they reached meadows on the edge of which now stands the railroad town of Newhall. Their starvation days were over, after more than four months in the desert. They were at the San Francisquito Ranch, and received every kindness. Their several ways and fates after that have nothing to do with this story, other than occasioning the observation that the ordeals they survived seemed to have strengthened their physical fiber. Many of those whose names have been

mentioned in the account lived well beyond the usual limits. Mrs. Brier, heroine, lacked but four months of being one hundred years old when she died. Her husband and sons all passed on before her time came. Manly died in 1903, aged eighty-three. Colton lived past his ninetieth birthday, and several others survived into this century. Captain Haines, who according to Stephens was sixty years old in 1849, died in 1889.

Panamint Tom, an Indian who reached the age of supposedly one hundred years and was old enough to be an active man in 1849, told R. J. Fairbanks of seeing the white emigrants leave Furnace Creek one hot morning. He said that the Indians could have saved the white people but did not.

It is hardly in order to say that the desert-surrounded emigrants camped at Bennett Wells might have bettered their hard stay; without doubt they did the best they knew. But if the men in camp for four weeks had trudged into the Panamint canyons they might have found running streams and water with which that at the well does not compare; they might have found grass for their oxen, better than the poor fare they had. The mesquite trees about them were laden with nutritious seed pods which to them meant nothing. But for them, doubtless the only thought was escape, as an unidentified writer was years ago quoted as saying, "out of the dreadful sands and shadows of the valley, its exhausting phantoms, its salty columns, bitter lakes, and wild dreary desolation." And their thought was, with that writer, that "if the waves of the sea could flow in and cover its barren nakedness it would indeed be a blessing, for in it was naught of good, comfort, or satisfaction — a charnel house, so dreary it required the strongest of faith to believe the Creator ever smiled upon it."

Much attention has been given during the past few years to tracing the routes of the emigrant parties. A small

booklet was published by Mr. John E. Wolff, of Pasadena, giving his belief as to the Manly party's course. Mr. Goodwin, Mr. Phil Townsend Hanna, Mr. Carl I. Wheat, and others have reached conclusions not agreeing with him. Mr. Wheat is preparing an extended résumé of all evidence available.

The beliefs of these investigators is that Manly and Rogers probably guided their party up one branch of Six Springs Canyon. From its head into Panamint Valley the route may have been either South Park Canyon or Redlands Canyon; both fit the descriptions given by Manly. The argument for South Park has the support of a statement by an Indian woman that her father told her the white people left that way.

The Brier and Jayhawker subdivisions passed around the north side of Tucki Mountain. Rediscovery this year, by Rockey Cochran and Farland Wells, CCC enrollees, and Tom Wilson, Indian, of a spring west or southwest of Tucki Mountain seems to supply a key detail of their route. It is west of Emigrant Springs, which the 'Forty-niners missed. Near the spring is a boulder on which are inscribed several names. They read: "W. B. R. 1849," believed to have been marked by W. B. Rude, of the Jayhawkers; "J. Hitchens 1860 Boston" (Hitchens was with Dr. French's expedition in 1860); "Frank L. Weston 1861," now unidentified; "T. G. Beasley," the name of one of French's companions and later an Owens Valley settler. Other markings are incomplete or partly obliterated: "lar," which may have been made by Andrew Larken, Jayhawker; "rier," possibly made by Brier, the first letter being missing. Many Indian petroglyphs are in the vicinity. This has been given the commemorative name of Jayhawker Spring.

Having missed Emigrant Springs, the Jayhawkers also missed the Wildrose water supply by keeping too far west. Crossing Harrisburg Flat, they passed through Nemo Wash, entering Wildrose Wash below the springs and

stream. They went on to what is now known as Indian Ranch.

Others of the travelers kept more to the west and went through Towne Pass and probably through Darwin Wash. Indians claimed to have tracked a party over that route. An Indian story, unsupported, is that a white man was found dead somewhere southwesterly from Tucki Mountain, with a broken leg and a bullet hole in his skull.

A question has been raised as to whether the "Last Camp" was at Bennett Wells, or farther north; and whether that watering-place was named for Bennett, of 1849, or for a later man.

Manly tells of the teams going south from Furnace Creek and, after traveling a short distance, turning west and crossing water. The second night they came to a spring of good water. This may have been at Tule Spring. The first borax freighters turned west about three miles south of Furnace Creek, crossed through water, and reached Tule Spring.

Manly tells of finding a hole of sulphurous water eight miles south of the spring. The distance approximates that from Tule Spring to Bennett Wells. Or it may have been another spring not now existent. Manly says nothing of the comparatively luxuriant vegetation at Bennett Wells, which might have partly hidden the wagons from his view when he and Rogers returned from their "forlorn hope" trip. He mentions fixing harness for the oxen while in the shadow of the wagons, there being no other shade. This could not have been the case at Bennett Wells, where there are numerous mesquite trees, some of venerable age.

Charles Bennett, Pahrump, Nevada, rancher, who took the first contract for transporting borax from the Harmony works, bought some of his horses in Owens Valley. A man who drove the stock from Owens Valley to deliver to him, and who drove a team for him on the borax route in 1883 and 1884, says that no designation other than Ben-

nett Wells or Bennett Hole was ever used for that place. Moreover, when it was mentioned by early writers, Hanks and others, Bennett Wells was the name applied; this in 1881, before Charles Bennett figured in the case. The record of the Dr. French party in 1860 is that it "camped at Bennett Wells."

It is also alleged that "Bellerin' " Teck, of Death Valley note, was surnamed Bennett, nicknamed Tex, and described by the additional "Bellerin'," and that the disputed wells may have been named for him. Inquiry has not developed any authentic support for this theory. Pacific Coast Borax Company records have no biographical evidence of this character, and the idea that the wells were named for him surprised them.

It seems improbable that the Manly party, exhausted as its oxen and people were, would have gone back as far as Tule Spring after reaching, probably, Bennett Wells. Manly's account of his return indicates Bennett Wells, except in the detail of shade.

Until more information is unearthed, answers to these questions must remain as they have long been accepted, with the burden of contrary proof on the doubters.

III. MORE FACTS

During thirty years following the experiences of the emigrants of 1849 Death Valley held an unchanged repute as nothing more than a waste and useless spot of which no good was expected and none said, a never-failing topic for the space writer and the romancer. Tales of Breyfogle's lost gold ledges and of the Gunsight masses of wire silver tempted prospectors to brave its hardships without ever achieving the reward they sought; and a few parties of men journeyed in and out with the single purpose of adding to their knowledge.

Common belief has it that Mormons sent by Brigham Young built a small furnace near the western foothills of the Funerals in 1857 to recover lead from ores they found. Dr. Darwin French is credited with having named Furnace Creek in 1860 from the fact of his finding such a furnace on that stream. But a visitor in 1866 attributed the name to the heat at that point. While a narrative published in 1873 referred to mineral discoveries by Mormons working in the vicinity of Death Valley, Andrew Jensen, historian of the Latter Day Saints, discredits the Mormon connection with the Valley by writing, in reply to an inquiry as to what is shown by the usually complete and accurate record of matters affecting that church's interests:

> Documents at this office show that Latter Day Saint settlers opened up some lead mines in the mountains about 30 miles southwest of Las Vegas..... The mines were given up. This was in 1857 or 1858.
>
> The same year it is also on record that some of the brethren started from Las Vegas to explore the country northwest. They penetrated the country about 400 miles in this direction..... During their trip they saw nothing worthy of note except a strata of gold-bearing quartz about 70 miles northwest from Las Vegas. Doubtless on this trip they skirted the edge of Death Valley, if they did not enter it, as 400 miles would take them some distance beyond Death

Valley; but I feel satisfied that our people never made any improvements at mining or settling in that section of country. The place where they found quartz must have been at what is called Specter Mountains on the borders of the Amargosa desert. Death Valley does not seem to be mentioned at all in our compilations.

An expedition headed by Dr. Darwin French was one of the earliest to enter Death Valley from the west. In its roster were the names of James Hitchens, M. H. Farley, Dr. W. B. Lilley, Captain Robert Bailey, Dennis Searles, J. Lilliard, and others, to the number of about a dozen. Some of these men figured afterward in the history of mining in the vicinity.

Fired by stories of the Gunsight Mine, they organized in Oroville, Butte County, California, and left that place in May 1860. Traveling by way of Visalia, Walker's Pass, Little Lake, and Coso Springs, they reached, camped in, and named Darwin Wash. From there they traveled across Panamint Valley and through a "rocky pass to a camp in Death Valley, 25 miles a little west of north from Furnace Creek. They discovered and named Furnace Creek. They camped at Bennett Wells, where they found wagons, ox yokes, guns, utensils, discarded garments, and toys abandoned by the emigrant children. They were satisfied that the pass they came through was the same by which Towne and the saved of the emigrant party had made their escape, which led them to name it Towne's Pass." Here ends the record of the experiences of this expedition, though the leader went back again.

There is no reason to dispute that French found a crude furnace at the stream he named, although no one among the later travelers mentions anything of the kind. But instead of the structures having been put up by Mormons, they may have been the work of Mexican miners who had been working on the Amargosa for some time, according to the following from the report of State Mineralogist Hanks, published in 1883:

Photo by Frasher

Entrance to Golden Canyon

In March 1861 eight or ten Mexican miners arrived at the Amargosa mines and began operations. Soon after the Indians made a raid upon them, taking nearly all of their provisions. This had occurred several times in the history of the mines. A mill was afterward built but was left in charge of two men after an unsuccessful trial of the ores. The Indians killed the men and burned the mill.

Hanks locates this mine nine miles from Saratoga Springs, and says of it that the veins are narrow but rich in gold; the gold is found in pockets, from one of which $11,000 was taken.

Dr. S. G. George, S. G. Gregg, W. T. Henderson, Dr. W. B. Lilley, Moses Thayer, and J. R. Bell, starting from Visalia on October 1, 1860, chose a better season for desert travel than did most of the other expeditions. Dr. George, in a letter to the *Inyo Register* in 1891, told of camping in Death Valley for some time. He wrote:

We had but little trouble in procuring water for ourselves and animals. We saw many birds of different kinds, ducks, doves, and any number of jackrabbits.

Water can be found by shoveling out the sand to a depth of three to five feet. It is true that many have lost their lives in search of water. We found parts of the skeletons of human beings within a few hundred yards of springs. They must have perished either for want of water or had drunk too much of it. . . . .

I found a curiosity on a mountain on the western side of Death Valley. It was in the shape of a washboard such as are now in use, and was about the size of our washboards, with a corner broken off. It was of marble, about one inch thick, and grooved as perfectly as could be done with instruments, and had evidently been used as a washboard. I carried it several miles, intending to take it home with me, but got tired and laid it upon a rock in hope that someone would find it.

The Hanks report mentions the George party, saying they remained at the emigrant camp for some time, prospecting the hills in every direction.

Although ten years had passed, the tracks of men, women, and children were distinctly seen, as fresh as if newly made; the irons of

the wagons were where they had been left. The remains of ox yokes were seen, which had been laid out for use on the following day, with the chains extended on the ground in front of each wagon, showing the number of oxen to each, and traces of the old camp fire were plainly seen.

Dr. George and his men did not find the elusive Gunsight Mine they sought, but on Christmas Day, 1860, they found an antimony deposit in Wildrose Canyon, and named it the Christmas Gift.

Henderson added another to the permanent names of that region when he climbed and named Telescope Peak, towering above their Bennett Wells camp. Anyone who has contemplated that majestic mountain, its summit more than 11,000 feet higher than the Valley, can appreciate the panorama to be seen from it, as described by John R. Spears:

> He climbed to the top of the highest of the Panamints, and standing there looked off over such a landscape as can be seen nowhere else on earth. To the west lay the Slate, the Argus, and, blue with the distance, the Sierra mountains. To the south rose Pilot Butte, the Calicos, and far away the San Bernardino range. To the north were the snowy White Mountains, while to the east, beyond the Funerals, were the Ivanwatch (Avawatz), the Granite, and range after range that had never been named. Between them all lay the valleys, yellow with sand and grease-bush, spotted with black lava buttes and brightened with the beds of soda, salt, and borax, that gleamed snow-white to the eye or turned to mirage lakes, with dancing waters and leafy borders, according as the sun's rays fell upon them. It was the picture of a desert; but if it be true that a picture is masterful in proportion to its power to stir the emotions, then the picture from that peak of the Panamints is not to be compared with any tawdry scene that needs the colors of vegetation to make it attractive.

The Hanks report, mentioned earlier in this chapter, says that the party camped two weeks at Wildrose Spring, which they named from the flowers found thereabouts. Near their Christmas Gift mining find they saw hieroglyph-

ics on the rocks—records, thus far not interpreted, of frequent occurrence throughout that region.

Dr. French and nine others made another trip into the region, in search of a place where the Indians shot golden bullets from their guns. This party included a number of men who were later pioneers of the western part of the county. Though the search lasted eleven months, including the time spent in Death Valley and elsewhere on the desert, they found no golden bullets, and probably very few guns in which to use such valuable missiles.

Next came Hugh McCormack, in March 1861. "He discovered and named McCormack's Wells, which may be found on some of the old maps," says Hanks. Such maps have apparently been lost in the nearly fifty years since Hanks wrote. The location appears to have been at what is now called Tule Spring. Six miles south, he found a spring which emitted sulphuretted hydrogen gas. From facts other than this description, this spring appears to be Bennett Wells, for the old wagons of the emigrants were seen there. At Mesquite Springs, eight miles south, he saw where the winds had blown the covering sand from over a skeleton, supposed to be that of a woman, from the bits of calico with it. Hanks notes that, near Bennett Wells, McCormack "observed a hill of stratified rocks, yellow and blue in such strong contrast as to suggest the name 'Curious Butte.' Near by he found flexible sandstone or itacolumite."

Dr. Owen and others of the State Boundary Commission went into Death Valley that year, 1861, but of their movements or discoveries no record is available. During the next two or three years there were some prospecting parties, or so occasional indefinite references indicate. No particular information concerning other visitors is recorded until Jacob Breyfogle made, in 1864, the find that gave the mining regions another "lost mine" tradition to lure the venturesome. A casual mention indicates that a

party of prospectors was wiped out in Death Valley by Indians in 1865.

In the early spring of 1866 Governor Blaisdell of Nevada and a number of companions made a journey into the Valley. That was the era when brethren of the press, such as Mark Twain, Dan de Quille, and other bright lights, were prone to publish as sober fact any wild imaginings that came to their minds; so when the present investigator came upon the name of R. H. Stretch as the author of articles telling of the Blaisdell expedition there arose an excusable question as to their complete reliability. However, the *Virginia Enterprise,* in which the articles were published, stated that Mr. Stretch was the State Mineralogist of Nevada, "a man of eminent scientific attainment, as well as a graphic and elegant writer." The fifteen articles, under a Death Valley heading, were largely devoted to territory outside of that area, but contained the following of interest:

Furnace Creek, April 27, 1866: The springs are all warm, about 80 degrees, highly charged with mineral water. The foothills are a curiosity, for they rejoice in every color but green. In some departed age they must have given sustenance either to Indians or an abundance of game, for their sides are completely mapped over with paths over which no foot has passed for many a long day. Once made, however, a trail will last for ages in this country. The wagon trail which we found in Death Valley, though made last fall, was almost as fresh as if but a few days old.

We found a party of prospectors, headed by Mr. Breyfogle, who had made their way from the sink of the Mojave in search of a fabulously rich gold mine which Mr. Breyfogle found about two years ago. They had been about three weeks in camp, but up to the time of our arrival success had not crowned their efforts. I calculated that rock would have to yield $250 to make it pay expenses, even if men could be found who would live in such a country, everything found. A life on Furnace Creek would be infinitely more unbearable than a sojourn in State prison.

On Saturday morning, April 21st, we left Hadley's Springs, the source of Furnace Creek. We came to a stream of water running

perhaps 100 inches. On either side the gravel bluffs were worn into the most fantastic shapes by the long continued action of wind and weather.

April 28: The thermometer must have stood at 120 degrees. Game there is none. A few unlucky doves found their way to the springs only to find their way to our kettles, and some of us tried roast lizard by way of variation. Must say they are equal to any frog that was ever cooked.

Stretch notes that a man named Gillis, of the party, wandered away and was lost.

Near Furnace Creek, found a small fire where a human being had been burned. Small fragments of bones and a few teeth led to the belief that they were Indian remains, as this is their usual custom of disposing of their dead; but some of our party suggested they might belong to the unfortunate men killed by Indians while prospecting for the Breyfogle ledge last fall. One piece of skull appeared to have been fractured.

Breyfogle found the remains of two jackasses and a mule recently killed and barbecued ten miles north of camp. They probably belonged to Mr. Stockwell, who left the sink of the Mojave to prospect in Amargosa Valley.

May 6: It really seems as though we are never going to get away from this dreadful place, but on Saturday night, while we were discussing which of the mules would be the best eating, for our flour and bacon were in their death struggles, the messenger for whom we had been waiting came in sight. He had been absent thirteen days.

May 7: Breyfogle's party prospected steadily for a rich claim Breyfogle had found two years before, without success. They developed a fine meadow and plenty of water about ten miles north of Furnace Creek and fifteen east of Lost Wagons, on the east slope of the Funeral mountains.

The name of the mountains is probably due to their peculiar appearance. They are principally light-colored rocks, but are frequently capped with heavy masses of black limestone or basalt, the débris of which, running down the slopes, gives them the appearance of being fringed with crape, a species of natural mourning.

Stretch's letters contain no reference to the striking natural features of the region except as herein noted. His mention of Lost Wagons does not accord with the placing

of that name on present-day maps; the latter are clearly wrong, as is shown elsewhere in this volume. One more quotation from Stretch shows some of the perils of exploration in that day:

> July 8: Indian troubles at Silver Peak and Red Mountain. Jack Waters was killed by shots from Indians. Boniface was struck in the thigh by a ball, and many of our horses have been stolen.

To the Gunsight will-o'-the-wisp there was now added the Breyfogle "lost mine" to tempt prospectors into that region, and no doubt each year added to the number of skeletons left lying, unknown and unsung, on the sun-baked sands. One "Bellerin' " Teck was so taken with Furnace Creek in 1870 that he decided to locate there. He took water out through a ditch from Furnace Creek and started a little oasis. The place looked so good to another wanderer named Jackson that he traded a yoke of oxen to Teck for an interest. The partners disagreed within a week, it is said, and Jackson decamped, leaving his land and his oxen, rather than wait to find out what Teck intended to do with a shotgun which he produced during the argument.

Another invader of the period was "Cub" Lee, for many years a desert resident. Lee, whose given name was Leander, had three brothers, Philander, Meander, and Salamander—a fact not bearing on this narration but disclosing a particular parental taste in naming. "Cub" and Philander grazed cattle on Furnace Creek vegetation for a season; it may reasonably be assumed that this was after the régime of "Bellerin' " and his shotgun.

One of Death Valley's historic high spots was the expedition commanded by Lieutenant George M. Wheeler in 1871. It is of interest, not only as the first official attention to the region, but also because of the unknown fates of two well-known civilian guides who disappeared during the journey.

Under instructions to obtain correct topographical

knowledge of the region south of the railroad across Nevada and in that state and Arizona, Wheeler traveled several thousand miles. The command comprised seventy-five officers and men, including experts in many lines of research. Wheeler commanded one of the detachments, Lieutenant D. A. Lyle the other.

Lyle and thirty-three men left Camp Independence July 21, at the worst possible time of year for such a trip. Crossing the White Mountains through Mazourka Canyon, east of Independence, they passed through the northern end of Saline Valley to the range on the eastern side. Their distresses had become acute, and C. F. R. Hahn, civilian guide, asked Lyle to remain in camp for a day while he went on to see if there was water enough for the party at Grapevine Spring, thirty-five or forty miles distant. Lyle's report indicates that Hahn was vague about the route. He set out, accompanied by John Koehler, naturalist, and an Indian. When at five the next morning he had not returned, Lyle and his men set out to follow. They had much trouble crossing the mountains, trying one box canyon after another, and were in desperate plight when at the end of the second day after Hahn's departure they reached a place they named Last Chance Spring, where water enough for all was found. Lyle's report is that tracks believed to be those of Hahn were followed, but of him they saw no more. Koehler, who had started with him, said that Hahn had left him at the summit of the mountains. Testimony later developed that Koehler had threatened to kill Hahn if he failed to find water. Lyle went on from Last Chance Spring, across the northern tip of Death Valley, to Gold Mountain. No search was made for Hahn, who was supposed to have been afraid to return to the party. Effects believed to have been his were afterward found in a canyon in the north end of the Valley, and in 1873 an Indian found field glasses believed to have been Hahn's between Sand Springs and Grapevine Springs.

Lyle returned to Camp Independence and on August 12 set out southward. He crossed via Darwin Wash into Panamint Valley and to Wildrose Spring.

To quote his report:

> Towne's Pass lay to the north of our camp. I dispatched Clarence King to Furnace Creek to find a pass over that range. I also dispatched Mr. Egan, the guide, who so kindly volunteered to lead us to this point, with two men to go to Cottonwood canyon, some distance up the range, there to meet and conduct you [Wheeler] to our camp. On the morning of August 19 he left them and went on ahead to the northward up the west side of Death Valley, to find that canyon, and having an excellent mule was soon out of sight. They followed his trail until 11 A.M., and found their mules failing so fast that they turned back to Marble Spring, a place they had passed the day before. After much suffering and fatigue they regained my camp. As Mr. Egan had appeared quite positive in his knowledge of the location of the point designated by you, I had not the slightest doubt but that he had reached the camp of the small party at that place; but to guard against any chance of his failure to reach that point, and in case he should return to Marble Spring, I sent a man to the latter place with a note, advising him of our movement across Death Valley, and also sent rations to be left for him there. I had no apprehensions for his safety, because he seemed perfectly conversant with the country. However, rations and a note were left for him at Rose Spring in case he should return to that place. Several days after, when the side party from Cottonwood joined us at Ash Meadows I learned that Mr. Egan had never joined them, and was supposed to have lost himself in Death Valley.

Lyle's official report proves that he and not Wheeler commanded on both occasions when the men were lost. Civilian employees told of an excess of the overbearing treatment that sometimes disgraces the attitude of a military commander, more particularly one new to his rank, toward civilians. There were tales of friction. It might have been that Lyle feared for the safety of himself and his men if he made the investigation that humanity should have dictated. The fact remained that no effort was made to ascertain the fate of the missing guides. If there had

Photo by Frasher

Ubehebe Crater

Photo by Padilla

Stovepipe Wells Hotel

been, Lyle's report would certainly have mentioned it, but a careful reading from address to signature shows no such indication. The report gives very little information such as Lyle was sent out to get; it is principally devoted to his hardships.

It seems probable that the Last Chance Spring reached on the first trip was the same as now shown on the maps of that region, at the extreme north end of Death Valley. Another story gives a different reason for its naming, to wit: Two bandits once held up a store at Silver Peak and struck out to the southward. The storekeeper started a party of Indians out to capture the men and bring them back. The bandits were trailed to Last Chance Spring, where they put up a fight and both were killed. Their bodies were covered with a mound of stones, and a reputable former resident of that section states that he has seen parts of the skeletons under the stones.

The first really worth-while investigation of Death Valley was made by Lieutenant Rogers Birnie, Jr., in 1875. With seven men, he left Cajon Pass, California, July 2, 1875, and spent that month and the next in the desert, mostly in the Death Valley neighborhood. Though the thermometer in the sun marked 145 degrees, they did not suffer from the heat as much as had been anticipated. One of their mules died from exhaustion. Weak animals had to be rested; a night march because of lack of water, and going without water, except the merest trifle, for forty-eight hours, are mentioned incidentally. But the hardships experienced are barely referred to, in the fewest words possible. The report as a whole is comprehensive in information, much of which is now too well known, or covered elsewhere in this book, to be repeated here.

They entered the Valley through a canyon in the Panamints, passing a running stream and a small place where vegetables were raised by irrigation, probably that now mapped as Hungry Bill's. They camped at Bennett Wells,

where good though slightly alkaline water was found. Birnie concluded, from his journeyings on the floor of the Valley, that the direction of some of the channels and washes made by flowing water had been affected by prevailing winds from the south.

Travel about the Valley was difficult, for in one place the party found soft marshy ground, in another a dry honeycombed surface, and in another a surface smooth and hard-baked. "We were compelled to leave our animals and make the rest of our journey on foot, sometimes sinking nearly to the knees in ash-colored mud beneath the salt," he wrote. "From Bennett Wells we moved northwardly along the western border and crossed to the northeast over the old emigrant road to Furnace Creek." Considering the absence of travel in that region, this route seems to have been that broken by the emigrant wheels a generation earlier.

About this time the discovery of the mining camp of Panamint, just over the summit of the western boundary range, started a fresh crop of prospectors through the hills all about. What their fates, how many of them perished, can only be guessed.

With the discovery of borax, or more accurately, with the attention of capital to the fields known to exist there, a new era for the mighty wasteland began. Aaron Winters, poverty-stricken desert dweller, heard from a passing prospector of the value of borax and cannily learned how to make a simple test for it. He and his frail wife went to the great marsh in the Valley, and found that his supposition was correct. This was in 1880. He sold the find to Wm. T. Coleman & Co., of San Francisco, and the period of industrial development was launched.

One more change has come: development of Death Valley as an objective for sight-seers. That had its inception in the providing of accommodations for miners and officers employed by the Pacific Coast Borax Company. The

demand for stopping-places for visitors led to construction of the Furnace Creek Inn, a high-class hostelry on a hill overlooking the Valley. H. W. Eichbaum, with praiseworthy courage, built a road in 1926 from Darwin Wash and through Towne's Pass and created Stovepipe Wells Hotel, where, as at Furnace Creek, every needful comfort now awaits the guest. Supervisor Charles G. Brown constructed an auto road to a summit almost overhanging the deepest of the Valley pit and at Dante's View erected a windowed observation lookout. Through the work of the Park Administration, roads which are not merely usable but good reach all the better-known localities. Death Valley today can be visited in as much comfort as any other of our wonderlands.

IV. CLIMATOLOGY

Teel's Marsh, Nevada, is credited with a recorded maximum temperature of 120 degrees above zero and a recorded minimum of 50 below. Against that range of 170 degrees Death Valley cannot compete, but it defies the world to surpass its average maximum. Geological Survey documents have suggested that on the beds of stone around the canyon mouths the heat may reach 150 degrees; and a magazine writer has guessed that out on the shimmering salt fields at times it may go to 160 degrees. Such assertions are safe challenges to credulity, for no tests have been made to disprove either claim. The actual records, under standard shelters for the thermometers used, are enough to satisfy the most ardent lover of warm weather.

A temperature of 134 in the shade has been noted at Furnace Creek Ranch, listed as Greenland in Weather Bureau records. It is said that the instrument would mark no higher; the actual maximum is left to conjecture.

Despite a "certainty" heretofore quoted, that "no man could survive there long enough to secure continuous observations of any extent," a record has been kept at Furnace Creek Ranch for seventeen years, except for a two-year break, and is so nearly continuous as to supply very definite information.

The first weather observations in the Valley were made in 1891, by Sergeant John B. Clery of the Weather Bureau. He was there for only five months, but they were the worst five months in the year, May to September inclusive. While his figures were of no great worth in establishing normals, he demonstrated (as had been done before) that a year-round stay was possible. He noted that prevailing winds were from the south and southeast, principally the latter. That detail has been disregarded in all later reports, but his notation serves to confirm the impressions of casual visitors. The greatest wind velocity he noted was 15.6 miles.

A voluntary observer's station was established in 1910, and more or less complete Weather Bureau records for the time since are available. The years 1920 and 1921 are missing, and figures are not complete in some other years. The data which follow are from the record.

While heat and dryness are the features receiving most attention from the public, Death Valley's standing in those details is no more nearly unique than in some other respects. A year with 351 clear days, for instance, is seldom noted in meteorological tables. A range of 119 degrees between the extremes of temperature is nothing to compare with regions where mercury solidifies in winter, but it does well enough. A place which can show a year with but three days on which measurable rain fell and where the total for one twelve-month period was but forty one-hundredths is indisputably dry.

That mean temperatures, so often quoted by real estate boomers, are misleading as a means of judging climate needs no better illustration than Death Valley. The annual mean there is the wholly pleasant one of 75.6; in computing it, extremes of 15 and 134 must be taken into account. So must 101.2 as a July mean—that is, average of all days and nights during that month.

Freezing weather may come in Death Valley as early as the second week in October, but commonly does not begin before the latter part of November, and sometimes not until December. February 13 was the latest date on which the thermometer marked as low a temperature as 32 degrees. Extremes of cold are brief. These figures should not mislead anyone into winter camping in Death Valley without ample provision for comfort.

The lowest temperature reached in the nine years ending with 1919, as far as covered by reports at hand, was 15 above zero. In the six years 1922 to 1927 inclusive, the lowest was 19, December 27, 1924. The earliest coldest day of the winter has been December 13; the latest, January 25.

That the air ever gets so cold in that sink may surprise those who have given chief attention to the upper end of the thermometer.

Extreme monthly maximum, minimum, and normal mean temperatures, complete, are available for the years 1911 to 1919, inclusive, as follows:

	Temperature		
	Maximum	Minimum	Mean
January	85°	15°	52°9
February	90	28	58.2
March	98	30	65.5
April	109	36	75.3
May	120	48	82.6
June	124	55	94.5
July	134	67	101.2
August	126	68	99.0
September	118	54	89.7
October	106	40	74.8
November	91	27	60.9
December	82	21	52.1

In the six years beginning with 1922 the highest temperature was 126. The coolest summer in the whole record was that of 1912, when the extreme maximum was but 120.

A surveyor in the Valley in 1883 took a few observations, the only one of present interest being that for forty-eight hours a thermometer located over running water did not fall under 104. The heat of the region, once developed, lasts well. Of not quite 1,500 days, from the spring of 1911 to July 1913, a maximum temperature of 100 was recorded on 548 days.

Precipitation records, by the Weather Bureau year of July 1 to the following June 30 showed, for 1912–13, 4.54 inches, conspicuous in Death Valley annals, for February brought a downpour of 1.90; 1913–14, 1.65; 1914–15, 1.31; 1915–16, 2.23; 1916–17, 0.43; 1917–18, 1.12; 1918–19, 0.52; next two years missing; 1922–23, 0.40,

all in the month of August; 1923–24, 2.71, with 1.70 of it in November; 1924–25, 1.86; 1926–27, 1.75.

Very little oceanic moisture ever reaches Death Valley, in the opinion of investigators. First the Sierra, then other ranges, take whatever the clouds have to give. The only channel through which vaporized ocean water reaches the deep deserts is the valley of the Colorado, reaching the Gulf of California. This accounts for whatever winter rainstorms may occur. Summer rains, when occurring, are attributed to the snow on higher desert ranges. The slight quantity of such precipitation is readily reabsorbed by the hot, dry air, and vegetation is not materially affected.

Fewer records are available covering air humidity than of any other detail of Death Valley meteorology; the five months' observations by Clery cover the sum total of actual knowledge. "Relative humidity" is the proportion of actual moisture in the air as compared with the amount which would make the air saturated, or at the point when the vapor would condense. The average humidity over land is about 60 per cent. This unscientific explanation may give a better understanding when it is stated that the relative humidity in Death Valley, at five o'clock in the afternoon, during the five months was 15.6, or in other words the air contained about one-fourth as much moisture as the average. For July it was 12.6; on the fourth and the fifth of August it was 5 per cent, and for the month 13 per cent.

Spears, in *Sketches of Death Valley,* says: "The air, raised to furnace heat by its passage over the deserts, is kiln-dried in the pit below sea-level, till the percentage of moisture is sometimes said to be less than 1." Harcourt, in the *Overland Monthly,* 1901, asserts: "The atmosphere at this point [the north end of the salt marsh] is thought to attain absolute zero humidity." Every particle of moisture having been guessed out of the air, the subject is left to await dependable observations.

Harcourt, already quoted, wrote: "Evaporation reaches a maximum of 1.1 inches in 24 hours, according to a government survey party." No other estimates of this detail are available; if the total were even more than stated, it would not be strongly questioned. None of the mountain streams find their way to the lower part of the Valley; while this is commonly attributed to their sinking in sands, the item of evaporation plays a part. That was given as an important factor of loss in the use of Furnace Creek for irrigation.

Among the popular old-time beliefs about the Valley was one that the very air, in places at least, was fatal to animal life. Afterward, that was modified to the statement that parts of the mineral marshes gave off poisonous vapors. The truth appears to be that life is extinguished through the physical effects of heat and the drawing off of moisture from the body. Birds have fallen in flight, and even from the limbs of trees in which they had sought shelter, because of superheated winds and kiln-dried air. Hanks's report of 1883 quoted a Death Valley visitor who said that he had picked up, at different times, two little birds, a mile or so from water, which had evidently just dropped dead, for their bodies were still warm.

Harcourt tells us that "at a temperature of 120 degrees, reinforced by the heat of breathing and oxidation, for eight or ten hours, the human body, but for the cooling effects of evaporation, would perish." Also, "through this arid air not even a seasoned man can travel without a dozen generous draughts from his canteen." The human body simply cannot take in enough moisture to withstand the all-enveloping heat.

A man at the Furnace Creek Ranch told of observing a branch of a pepper tree dry up and die, though it had plenty of water; the system of the tree could not supply moisture fast enough.

A man died from heat on his bed at the ranch house.

When the thermometer is at 90, one can sleep in comfort, because of the dryness of the air. But when the mercury goes much higher, protective means must be devised. Denton made his bed in front of a revolving fan driven by an overshot wheel, sprinkled the floor and his bed with water, and so managed to get along. Others, less inventive, slept in the water of Furnace Creek, with their heads braced up to guard against drowning. One, describing a period when the heat was 128, with a hot wind blowing, said "we laid on the floor and tried not to go crazy." Men frequently soaked their blankets thoroughly and wrapped up in them as a means of coolness.

The sun is merciless during the hot weather. The number of clear days recorded varied from 322 to 351, averaging 334 for the calendar year; of partly cloudy days there were none in three of the years, and in the three others of which there is record, 2, 3, and 11 were set down; cloudy days per year totaled from 13 to 43.

Comparatively rainless though the Valley is, two different visitors have reported being on the salt marshes when snow fell. The author of this volume experienced a hard, driving snowstorm on Dante's View, but that was 6,000 feet above the Valley floor.

The writer has not encountered, in a number of visits, anything remotely resembling the windstorms of which some have written, if exception is made of a cold blast on the summit of the Black Mountains. Even then the bottom of the great pit showed no sign of dust cloud, and the air was probably calm at that lower level. Sergeant Clery's record, showing a wind velocity of 15.6 miles per hour during his five months of stay, indicates a generally quiet atmosphere.

But the existence of the dunes, with their surfaces rippled as by waves, bears out the different story of other visitors. Evidently the Valley is moody and uncertain in its natural manifestations. Spears, writing in 1891, said:

A sandstorm, more or less severe, is making Death Valley uncomfortable about half the time. I have this statement from several men familiar with Death Valley and the desert round about.

A report by State Mineralogist Hanks mentions "a burning wind, fierce and powerful, blowing particles of considerable weight some distance, and hurling the coarse hot sand with such force as to lacerate the face when exposed."

Here is an impression of a Death Valley sandstorm, by Spears:

I awoke there one morning to find the wind blowing from the north down the valley at perhaps twenty-five miles an hour. The sun was shining dimly. To the east, particularly where the sun was shining above the peaks of the Funeral Mountains, the air was full of a whitish haze. To the west, the landscape was blotted out by a dense brown fog. Neither foothill nor face nor snowy crest of the Panamint Mountains could be seen. Indeed, neither greasewood nor mesquite tree could be seen in the valley half a mile away in that direction, nor was the vision much less obstructed to the north and south. A sandstorm was raging throughout the valley, and the air was smoked with the dust so high that even the highest mountains were obscured.

The face of the sun was a great white disk, that faded and brightened alternately without entirely vanishing or becoming too bright to look at, and yet no outline of a cloud could be distinguished.

Along the axis of the valley the dust fog was densest, and here its highest strata seemed frayed out into waving feathery streamers, while the dark brown masses below them showed light and dark shades of density. What with the sun showing ghostly white, and a seemingly stationary fogbank in a gale of wind, the spectacle was indeed strange and weird.

But if strange from within, what shall be said of the sandstorm as seen from the top of one of the higher mountains that border the valley? The whole space between the ranges was filled with smoky billows, rugged and torn and tossed about, and rising up till all the foothills and half the heights themselves were covered. Sharp squalls plunged down the canyons and gulches, and there gathering the dusty forms in their arms went whirling away in gigantic waltzes. It is no wonder that the Arabs of the desert country, the Piutes, believe in witches and supernatural powers in the air.

It is a marvelous spectacle when a sand-auger travels down the valley. Astonishingly slender in form, it rises, writhing and twisting, sometimes a mile in the air. With a faint puff or cloud at the top and a slight spread at the base, away it goes, sagging and swaying hither and thither, until somehow it all unexpectedly vanishes out of sight. I saw two such augers. Both were more than 2,000 feet high. Neither journeyed a mile, but when they faded away there was no sign of a falling cloud or a thickening of the dust in the air where they had been. They simply disappeared ghost-fashion, as I was looking at them.

The sandstorms commonly last for three days. The one I saw lasted but two. In the afternoon of the first day the speed of the wind increased rapidly, until it was probably traveling at times as high as fifty miles an hour—perhaps more. At this time the gusts picked up pebbles as well as sand and dust. The air near the earth was full of flying missiles.

It was a winter storm that I saw. In August the case is different. Day after day the sun beats down from a cloudless sky on this desert pit. The earth grows hotter and hotter as the days pass, till the naked hand cannot bear to touch even the woody parts of the sage and grease bushes, while a rock or a bit of iron scorches as if from a bed of coals. The air glows, and dances, and bakes. And then comes the cloudless gale, gathering heat as it hurries along between the blazing sun and the white hot sand of the desert, until at last it bursts in through the passes of the Panamints like a blast of flame. There it picks up the hot dust and sand, and tossing them aloft in clouds converts the valley into a veritable pit of hell.

With storms moving the sands about in such masses as to build the great dunes, how is it that the tracks of the 'Forty-niners lived in the Valley until they were plain to those who came ten years later? Desert men say that it is not impossible; that the sand packs under pressure, so that, while one zephyr may fill a track, the next will sweep it out again and leave it as before. If that be true, it may be that somewhere in that little-traveled Valley there are yet tracks which have not been altered since the emigrants made them.

It is said that the atmosphere has a tendency to cause lassitude and weariness and intense thirst on slight exer-

tion. Many of those who live there for any length of time complain of an affection of the eyes. A very short walk will cause great thirst, and at times even the raising of the canteen to the mouth seems an exertion. All of which we can neither confirm nor deny.

It needs no argument to prove that the Valley in summer is a place to avoid. But through the colder months, its climate becomes a delight, and men who go there at such times, willing to appreciate its charms, are thenceforth recruits to the army of those who truly enjoy it.

V. WATER

By comparison with many other deserts, Death Valley is well supplied with water. Few of its several streams ever get to the lowlands; Salt Creek's sluggish flow, useless to mankind, is the exception. Common understanding is that the west side, along the Panamints, is better watered than the eastern part. This is explainable, for the range named, being both higher and nearer to the coast, receives more snow.

There is little of the Death Valley water supply that would be pronounced good by one accustomed to the flow from Sierra canyons. If it is not warm, as much of it is, a mineral taste of one kind or another is found; usually it is both warm and mineralized.

Bad Water, the sump at the Valley's lowest point, once received some flow from the Amargosa. That stream, rising in the wastelands to the north and east, had a U-shaped channel around the southern end of the Black Mountains. But since 1850, the United States Geological Survey says, the river has never carried volume enough to reach the sink. What happened earlier, and when, is a matter of surmise and deduction, since there were none to observe. Loaded with the minerals that gave it the name of "bitter," whatever it dumped into the sink helped to make the accumulation the concentrated essence of liquid uselessness.

Furnace Creek is supplied by several springs, which appear to have been given different names. A Geological Survey report mentions them as Coleman Springs; the *Furnace Creek Quadrangle* gives no name. Texas Springs, a little to the north, add to the stream lower down. The total flow is stated as from 80 to 100 inches. The natural temperature is stated to be 74 degrees; in summer, after flowing through sun-heated pipes, the water is unbearably hot. Hanks, in his report of 1883, said: "It has been stated

that during some seasons the temperature of the water is 120 degrees."

Cow Creek, in a canyon on the west slope of the Funerals, eight miles northeast of Furnace Creek Ranch, sends down "an abundance" (said to be 45 inches) of good but lukewarm water. Formerly soaked up by the sand before entering the Valley, it is now utilized by the CCC camp.

Cottonwood Creek rises in springs in Cottonwood Canyon, some eleven miles west of Stovepipe Wells, and sends a comparatively cool stream two or three miles toward the desert, giving life to a fringe of cottonwood trees and other growth.

Grapevine Springs water a green patch on the slope of the Grapevine range, a short distance north of the canyon of the same name. In the course of a trip through that neighborhood we crossed a flowing stream probably two miles below, evidently from these springs, but that flow was taken as unusual.

Steininger's, now Scotty's, Ranch, in Grapevine Canyon, is well watered by the output of springs rising a short distance above. The water is freely usable, but has a musty or mineralized taste.

There are two streams called Willow Creek: one in the Black Mountains, about ten miles southerly from Bennett Wells, the other south of where the monorail line crosses the Panamint Valley. Both carry fine water.

Hanaupah Creek is in the Panamints, directly west of Eagle Borax Works. It is doubtless the stream referred to by Professor Jepson in his notes in the chapter (chapter vi) on "Plant Life."

Salt Creek courses down the middle of the Valley, its small flow contributing to the marshiness of the great salt flat from its channel southward.

Bennett Wells, the last camp of the Manly-Bennett party, is a small pool a little below the surface. It was dug out and enlarged, and surrounded by a rough fence

to keep stock out. The Pacific Coast Borax Company paid some attention to its improvement, erecting a windmill, which still stands on its steel tower. The water supply appears to be ample, and for that region is fair in quality.

Enough moisture comes from springs at Eagle Borax Works to maintain a heavy growth of tules and considerable meadow, the home of the half or wholly wild equine population of that part of the Valley.

Salt Well, beside the road and four miles southwest of Stovepipe Wells, is a pothole with water that is strongly saline but otherwise palatable. Stock drink it more willingly than human beings do.

Sand Springs furnishes the first Death Valley water found by incoming travelers on the route from Lida, Nevada. An ambitious homesteader sought to settle there, and on abandoning the undertaking left a small cabin and a lonesome tree, nourished by the trickle of musty-tasting but safe water brought through a few lengths of iron pipe. All about the spring are the bones of cattle which, while ranging in the hills to the northwest, were driven out by snow and went to Sand Springs to do their starving to death. The place is a favorite camping spot.

Daylight Spring is in the side of the hill on the north side of Boundary Canyon, sometimes called Daylight Pass. Its flow is said to be about eight barrels of good water per day.

Hole in the Rock Spring, five miles southwest of Daylight Spring, is a seep hole with a few gallons of water.

Bradbury Well, close to the main road across the south end of Death Valley, is a welcome camping spot. The water, of fair quality, is drawn up by means of a bucket from a boarded and covered well.

Last Chance Spring is at the extreme northern end of the Valley. No information about it is available.

Triangle Spring, a short distance north of Stovepipe Wells, is credited with a small but good supply of water.

Surveyor's Well, northerly from Triangle, has good water, slightly brackish.

Stovepipe Wells consists of two holes about five feet deep, containing plenty of good, though mineralized, water.

Many more springs are listed by the Geological Survey and other authorities, and it is said that Indians told R. J. Fairbanks of the locations of at least a hundred, on his agreeing to keep the knowledge to himself while the Indians survived. Inspection of a map of desert watering places proves that Death Valley has more springs and water holes than Panamint Valley, its higher neighbor, while Eureka Valley, a twenty-mile depression neighboring Death Valley's northern arm and just now the scene of sulphur-mining operations, is without a single source of water.

Yet it is to be hoped that no person will be foolhardy enough to take chances in any of that country without knowing where his water supply can be replenished. No published map or description is a guaranty of finding water at the more obscure spots, for many of the springs are seasonal, depending on the amount of winter precipitation stored in the earth. Many a tale of lost lives in the region turned on the victim's hoping to find water where he had camped before, only to find on arrival that the water source had dried up.

Some Desert Watering Places, Water-Supply Paper No. 224, says:

> As a rule the water found at high elevations comes from rocks free from alkalies and is pure and sweet. In hunting for these higher springs one must go up into the bare rocky gulches, above the loose materials into which the rain waters sink so readily and are lost. The mountain springs are small and most of them disappear during the drier periods.
>
> In the lava or granite ranges water from the winter rains often collects in rock bowls. Where these are in the shade and are protected water may remain in them for months after a storm. Such

Photo by Frasher

Bad Water

Photo by Frasher

At Bennett Wells

natural reservoirs are known as "tanks." After a series of long dry seasons they are not to be depended upon.

In the vicinity of the dry lakes water can generally be found by digging or boring wells. The favorite place for undertaking such development is not in the mud flat, but around its borders. The waters in the centers of the sinks are impregnated with salts and generally not usable. The waters found about the borders and a short distance back are relatively pure, since they have not yet entered the highly alkaline area.

It has been asserted that no place in Death Valley is more than fifteen miles from palatable water. Digging only a few feet will usually strike moisture, whatever its quality. Good water was found at Furnace Creek Ranch by sinking eighteen feet. Hanks states that McCormack found it at a depth of four feet, at McCormack's Wells.

The Survey bulletin says on the subject of vegetation as an indication of moisture:

The presence of dead sycamores or cottonwoods usually indicates the lowering of the water table, and it is not likely that a supply will be found within twenty feet of the surface.

Although mesquite trees grow where water is abundant, their presence is not a good guide to water, for the growth may depend on either the proximity of the ground water or the periodical flooding of a small area. Where its growth is due to ground water it furnishes no suggestion as to the depth of water. It may be within a few feet of the surface or it may be fifty feet below.

Tules, or bulrushes, always indicate water at or very near the surface, and generally water of good quality.

Lowland purslane and wild heliotrope indicate water, but water may be of poor quality.

Where arrow weed grows to a height of 6 or 8 feet in a dense tangle, it is reasonably certain that the ground water lies within 20 feet of the surface and that its quality is at least fair.

Salt grass indicates water very near the surface, but the water may be very brackish.

Creosote and other shrubs of the greasewood group grow in the driest of soils, and their presence may generally be taken as an unfavorable indication.

A traveler can rarely see exactly where water is to be found,

except by going over the camp ground and looking carefully for wells. Many of the wells are mere shafts, 20 to 40 feet deep, covered with a few boards, which may in turn be covered by drifting sand.

An inexperienced traveler should not enter the desert alone. If he cannot find an experienced companion, he should proceed with the greatest caution, gathering all possible information about his route in advance, keeping himself abundantly supplied with water and food, and never leaving one water station without a definite idea as to the location of the next.

Indians put up water signs in places, frequently a white stone set on a monument, or a mound of stones. Dr. George, one of the Valley visitors in the 'sixties, wrote:

There is one sign that has never failed to lead me to water. If there is water in a ravine, you will find a white rock placed on a large rock. Looking up the ravine you will see another white rock laid up in plain sight. By following this sign it will lead you to water. This is an Indian sign well worth remembering by anyone traveling on the desert.

White prospectors put up mounds, sometimes an old tin can on a stake. It is said that the hieroglyphics found in many places in the Death Valley country are reliable water indicators, the caricatures of deer being headed in the direction in which water is to be found. In many cases some marker is necessary, there being little vegetation about most of the water holes.

"Poison Spring" appears in many places on the maps. A common supposition is that arsenic is the dangerous factor in such waters. An engineer of the Geological Survey wrote:

The writer has examined the waters of several of these, but has failed to find any arsenic or similar poison, though he has found large quantities of sulphate of soda (Glauber's salts), and some sulphate of magnesia (Epsom salts). Salt Spring, in south Death Valley, is of this character, and prospectors are known to have perished there, so that the spring is called "poison" by many, but it contains only sodium and magnesium salts, and no arsenic or copper.

The intense heat of the summer, the exhausted condition of the famished prospector, and the abundance of these harmful salts in the waters are sufficient explanation of the deaths that have occurred. Such waters are dangerous to a hearty, healthy man who uses them with the greatest moderation, and they may be quickly fatal to the thirst-tormented sufferer who drinks them without restraint.

Another published note says that any spring above sea-level is commonly considered safe.

Wild-horse trails lead to water; sheep trails may bring one to a twenty-foot cliff.

One more detail of water in Death Valley remains to be mentioned—the appalling cloudbursts which sometimes sweep down its canyons, stripping all covering from the bones of the earth and building up the fans which spread out toward the lower levels. The desert regions appear to be particularly liable to these sudden inundations, as if water-laden clouds were reluctant to return to solider form but on the persuasion of contact with a mountain top change to liquid at once. The work of such brief but terrific floods is seen below many of the canyons.

No one should undertake to travel the long and lonely desert roads without the completest obtainable information about where water is to be found. The excellent Death Valley map published by the Automobile Club of Southern California indicates the location of many of the watering places and its signs point to them. *Some Desert Watering Places, United States Geological Survey Water-Supply Paper No. 224,* lists many. No such help, however, equals a guide who really knows the territory and the ways of recognizing the locations of the dependable springs.

United States Geological Survey topographic sheets, always valuable on such trips, may be obtained in any city. Those mapping Death Valley are for the Lida, Ballarat, Furnace Creek, and Avawatz Mountains quadrangles.

VI. PLANT LIFE

Though this desolation cannot be said to be generously supplied with vegetation, neither is it the plantless waste that is sometimes pictured. "Neither water, vegetation, nor animal life are to be found in Death Valley"; "a few mesquite, growing among the sands at its head, is all the vegetation to be found"; these are sample quotations for which there is no excuse other than complete ignorance of the facts.

This applies to the floor of the Valley, as well as to the entire watershed, all of which we consider in referring to botanical as well as other general features. Square miles of the marshes are of course absolutely barren, and so are some of the slopes and fans; but those do not create a rule. It is of course understood that the alien growths introduced at Furnace Creek Ranch are disregarded.

Large areas present the same appearance as to plant life as does the Mojave Desert in general. As on all deserts, bushes are generally widely separated, each being from several feet to several yards from its nearest neighbor. Nature has allotted to each its opportunity to secure its share of the soil's scanty moisture, as well as plenty of light and heat. There is no shading to restrict growth, and in consequence plants commonly spread equally in all directions, according to their habits, either natural or as developed by the environment. The result is that desert bushes are rounding and spread, and seldom or never in the cone shape that is sometimes found in more crowded situations. This general rule may be modified in such exceptional cases as the heavy vegetation along the water courses in mountain canyons, near a few of the springs and wells, and sometimes near the moist marshes. ("Moist marshes" may seem to be redundant language; the reader should bear in mind that "marsh" in the desert may mean a practically dry alkaline surface.)

The statement, from personal observation, as to profusion of vegetation in some situations is amply supported by the expert evidence given by Frederick V. Coville, the chief authority whose investigations of Death Valley botany have been published. In this quotation from his report we substitute common names for technical botanical designations:

> The surface of an alkaline marsh is likewise devoid of vegetation, but its margin supports in many cases a luxuriant growth. A section at Bennett Wells from the salt marsh to the mesa illustrates the flora of such an area.
>
> First, there occurs a strip a few meters broad of [iodine bush]; next, a similar strip of [desert rush]; and, third, a belt of [bunch grass] and [arrow weed] about 300 meters broad. Across the second and third belts [salt grass] occurs sparingly, mixed with the other plants. Over all these areas the thin alkaline crust on the soil is continuous or nearly so, and there is no loose sand. The fourth belt consists of [honey mesquite] and [shad scale], intermixed in some cases with *Suaeda suffrutescens*. Sand has drifted into clumps of these plants, so that the ground consists of a succession of dry hummocks, the hollows between them showing either a slight alkaline efflorescence or in some cases an incrustation. At one point this belt is about 750 meters broad. The next belt is made up principally of [greasewood], with a few scattered specimens of [creosote bush]. The soil is a mixture of gravel and clay, with some visible trace of alkali. The sixth belt is that of [creosote bush]. The soil is composed of sand and gravel, seldom showing a trace of alkaline deposit on its surface. Along the margin nearest the preceding belt [desert holly] is abundant.

Not so bad a showing for a region reputed to be "utterly barren."

Or observe the vicinity of the Eagle Borax Works, a little farther north. A large spread of green marshy meadow contains sloughs and pools of standing water, well fringed with rushes.

A writer who spent enough time in the Valley to produce some generally accurate chapters informs us that "not a green thing grows there naturally." On the contrary,

large areas are so colored by the dark green of the creosote bush, with occasional clumps of mesquite, that a visitor unacquainted with that kind of country might justifiably anticipate coming to farming land. It is true, however, that most varieties of desert plants are comparatively devoid of color. The silver-gray of the desert holly, the pale bushes of different varieties which in that locality are commonly referred to as sagebrush but which are something else, and in some canyons the gray-green shrub locally known as rabbitbrush, with its spikes of pale yellow flowers, blend into the sea of brownish-gray sand and minerals. Approaching the Valley by night through one of the passes where washes have occurred, notably Wingate, one must look to the form of the walls beside the road, as revealed by auto lights, to know whether he is passing bushes or earth banks; the color is practically the same in each case.

Even in situations where water gives life to comparatively rank vegetation, the prevalent shades are greens, either yellowish or paler than that one usually associates with the forms of life there visible.

Notwithstanding, the traveler at a favorable season may find fields of wild flowers of varied colors. The "fan" below Boundary Canyon displayed a spread of blossoms sufficiently closely set, as viewed from a little distance, to tinge that part of the landscape. Yellow is the prevalent color, with occasionally some blue, purple, or pink in varying shades. The beautiful little spotted mallow lifted its lavender and crimson cup above bronze-green leaves on a tiny six-inch stem. The blooming days of these plants, strangely thriving in such frequently superheated and rarely watered surroundings, are short indeed. Probably a fortnight after that visit, hardly a withered stem remained to prove Nature's pathetic effort to brighten the severe surroundings. In one springtime, after comparatively copious rains, such a show may be visible; the next corresponding season may be one of drought, and the seeds of

the little annuals may hibernate another year awaiting more favorable conditions. The matter of water supply, slight though it may be, profoundly affects the desert growth and its maturity. Coville records that an investigator who, after one very wet winter, found a certain desert plant ten feet in height, the next year, a very dry one, found in the same place mature specimens only four inches high. Conditions that will make such a difference in the growth of a plant will of course prevent the growth of many others.

The salt marshes are devoid of plant life, with a very few notable exceptions. To the west of the road between Furnace Creek and Stovepipe Wells a few clumps of mesquite are visible, seemingly rooted in the saline whiteness. It may be that in such spots peaks of soil, former hills or sand dunes, rise to the surface and have caught wind-blown seeds. Scientific investigators may explain that for us; the bushes are there, island-like in a worse than briny ocean.

Next to the marshes, the sand dunes promise least encouragement to vegetable life. Probably one reason for their showing no more plants is the frequent changes of their surface. A lodged seed has not time to germinate before its bed and it as well whirl away in a dusty cloud. The soil itself is not unfavorable, for in many places the beginnings of new dunes are seen where drifting sands have begun lodgment against growing mesquites, and in each a tree lifts half-buried arms from the hillock as if in despairing appeal against certain fate. Each storm will bury it deeper, and in time the mound will give no evidence as to what is beneath it. Now and then, however, a mesquite will be seen triumphantly growing on a dune.

Near the dunes and on them in favorable situations the lower desert bushes grow in fair profusion. The writer recalls vividly that one night it became necessary to illuminate an effort to extricate a car which had ventured where

a dune had risen across a well-defined roadway between Stovepipe and Stovepipe Wells Hotel. The car dug downward into the sugar-fine sand as far as its wheels could find material to throw backward. Six hours of patience and persevering and experimenting to secure traction were used in moving ahead. Now half of the time was after dark, and a large fire was kept up by means of brush broken off within the firelight's radius. With other possible deductions is the one that there was no great scarcity of fuel.

In Death Valley, as in other hot desert regions, are found surfaces thickly strewn with small flattened stones, brown or black in color. Scientists tell us that the color is due to the presence of dioxide of manganese, developed by the intense light of long periods of time. Such places occur on higher ground, the stones being bared by the gradual washing down of the soil. Coville asserts: "These so-called sunburned areas in Death Valley bear no vegetation whatever. . . . . The soil, a firm clayey one, is good, and the surface receives just as much rain as other parts of the valley. The phenomenon is explained by no hypothesis except the intense heat." With this, even from so eminent an authority, we must take issue, having seen tiny desert flowers in the soil of just such beds—not many, but enough to say they were there.

Somewhat incoherently perhaps, let us digress to discuss briefly the part that Death Valley plant life played in the existence of the natives of that region prior to the advent of the white men and their food supplies—and possibly still plays to a smaller extent.

Indians there, like many other tribes, had their location definitely set by custom and belligerent neighbors. To the northwest of them were the Saline Valley Indians, not much more fortunately situated than themselves. One autumn the pine-nut crop failed in the Saline region, and starvation drove the Salines to venture across the mountains west of their habitat. Word of their poaching on the

Photo by Frasher

Desert holly

Photo by Frasher

Niggerhead cactus

Owens Valley Indian preserves was the signal for war, and the invaders were driven back, to starve or to live as they might. This bears on the Death Valley Indians to the extent only that it pictures their own usual circumstances, so far as expectation of assistance from other tribes was concerned.

Their meat supply rarely rose to the grade of mountain sheep; of rabbits there were few, and even the chuckwalla and the rat graced the sandy tables only too seldom. The universal pine nut was found in the Grapevine and Panamint ranges, usually but not always. Finding additional food materials was a necessity. We may imagine that more than one Indian illness was accounted for by unique experimenting in that direction, but something of a standard dietary was evolved. Thus they learned that there was food value in some of the plants that grew about them.

The fleshy prickly pear lobes were broken off, scoured free of their bristles, and dried for later use. The thorns of the devil's pincushion protect large supplies of seeds, borne in woolly capsules; these were carefully broken out and the seeds kept, fresh and edible for months if so desired. Forms of the evening primrose, of grasses that are heavy seed bearers, and of the joint-pine shrub all yielded stocks that were winnowed out and crushed to be cooked as meal. In some of the canyons is found a forbidding but edible species of gourd, probably what is elsewhere termed the coyote melon. Manly's story of a raid on supplies probably refers to this poor food.

F. V. Coville, writing of the Indians of that region, says: "There grow in the desert several large crucifers whose leaves and stems have about the taste of cabbage and are tender and probably easily digestible. . . . . The leaves and young stems are gathered and thrown into boiling water for a few minutes." They are then repeatedly washed before being eaten.

Probably the honey mesquite ranked next to the pine

nut as a food reliance. Its bean-like pods carry hard seeds, also a sweet and nutritious pulp. The pods are sometimes fed to horses and mules, filling the purpose of grain. The seeds were crushed for human food. The emigrants of 1849 had this resource all around them and could have improved and varied their starvation diet had they but known it.

Seasoning for these supplies offered no difficulty. Salt enough to supply the world was ready for gathering. For sugar there was the common reed, ready to be cut, dried, sifted, and worked into a sweet gum-like mass. It may have been a store of this substance which Manly's associates raided in their journey through Furnace Creek Wash. If thus getting something sugary was too much labor for the native, he could, by scraping one of the forms of reed found there, procure a supply of tiny bugs which are said to have a sweetish taste. We are unable to confirm this from experience. From such supplies the Death Valley native eked out his hard existence.

Contrary to what might be supposed, the cactus is not an obtrusive detail of Death Valley vegetation. The altitude, or lack of it, appears to be too low for the grotesque Joshua tree, *Yucca arborescens,* of other western deserts. Different plants not classed as cacti are thorny enough to be handled with care; but of cacti the forms listed include only the prickly pear, *Opuntia basilaris,* the fleshy form showing large, beautiful, pinkish blooms; *Opuntia echinocarpa,* a loosely branched bush with a multitude of sharp needles; *Echinocactus polycephalus,* "niggerhead cactus," an illustration of which is given as an indication of its possibilities for misery for animal life coming in contact with it; and *Mamillaria tetrancistra,* "fish-hook cactus," which starts like bunch grass and matures into a mass of sharp, hooked spines. Robert Kessler, botanist, writes: "There have been discovered many new plants in the Death Valley region since Coville went through there. Cactus collectors

have found many varieties there that Coville does not mention."

A descriptive circular lists the cholla, *Opuntia fulgida,* among Death Valley plants. This is a shrub a few feet high, with contorted branches, densely covered with short, dry, barbed spines. The Indians have a belief that the needles are flung at the passer-by, this doubtless arising from the fact that they come off at a touch. Of this plant some unknown rhymester wrote:

> The devil was given permission one day
> To select him a land for his own special sway.
> So he hunted around for a month or more
> And fussed and fumed and terribly swore,
> But at last was delighted a country to view
> Where the prickly pear and mesquite grew.
>
> An idea struck him and he swore by his horns
> To make a complete vegetation of thorns.
> He studded the land with prickly pear
> And scattered the cactus everywhere;
> The Spanish dagger, sharp-pointed and tall,
> And at last the cholla, to outstick them all.

However, the species is not mentioned by any botanist who has listed Death Valley plants. Some of them do not admit it as Californian, nor have we any direct statement from anyone who claims to have found it there. Evidence against the cholla having a place in Death Valley botany is only negative, but possibly correct.

Chief of all Death Valley expeditions in collection of knowledge of the flora and fauna of that region was one in the early months of 1891. It was made pursuant to Congressional action looking to studies of plants and animals of the continent. Frederick V. Coville, Assistant Botanist of the Division of Botany, detailed to conduct the expedition, had as an assistant Frederick Funston. Funston, who was later to take up military life and make a notable record in the Philippines, as the captor of Aguinaldo, and other-

wise, had not yet "found himself," and had little to do with achieving results on this expedition.

Coville made his main camp at Bennett Wells, and traveled back and forth from there on his researches. He did not himself visit the northern arm of the great sink, where natural conditions are very different from those surrounding his camping place. Funston crossed the Valley farther north, however, apparently past Stovepipe Wells and to the vicinity of Grapevine Peak. It may be assumed that the presence of the wild grape accounts for the naming of Grapevine Springs (on the Valley's floor), Range, and Peak; Coville does not credit it to Death Valley, though mentioning it as found at Ash Meadows and in canyons on the west slope of the Panamints. But whatever its omissions, the Coville catalogue still stands as the most complete listing of Death Valley plant life ever published.

In reprinting Coville's catalogue, from *Botany of the Death Valley Expedition, 1891,* we can do little for the expert botanist beyond stating the names and suggesting reference to a standard work such as Jepson's *Manual of Flowering Plants of California.* This not being designed as a guide or reference chapter, the casual reader's purpose will be served by giving the common name, as well as the technical, with some brief descriptive matter. Friend reader may readily understand this description:

Scirpus acutus—Stems arising from stout creeping woodstocks, terete or very obtusely trigonous above, leafless or with a short terete leaf from the upper basal sheath; inflorescence apparently lateral, 1 to 5 inches long; involucral bract stout, shorter than the inflorescence; spikelets 3 to 6 inches long, numerous, congested capitate, or in an irregular umbel with unequal rays; scales ovate, ciliate, shortly awned, ¼ to ½ longer than the achene; bristles 6, slender, retrorsely barbellate, slightly shorter than or about equaling the achene; style 2-cleft; achene lenticular, gray, abruptly mucronate.

You may know someone, however, who will get a better picture of the plant if we simply call it "common tule."

This is the Coville catalogue, as to names, with every-day explanations from other sources or from personal observation:

DEATH VALLEY PLANTS GROWING IN MOIST SOIL

Trees

Prosopis juliflora—Honey mesquite.
Prosopis pubescens—Screwbean mesquite.

The two varieties, which are deciduous, flourish in different places on the floor of the Valley as well as in the canyons. Bennett Wells has an extensive grove, and in that location of comparative freedom from the blighting effects of sandstorms and sand dunes many of the trees have reached a venerable age. One there measured by the author was found to be 49 inches in circumference; it probably stood when the 'Forty-niners were camped near by. The leaves of the tree resemble those of the locust, though rather narrow, and the branches are well armed with thorns. Flowers are greenish-yellow, in spikes.

The mesquite has seemingly little regard for the nearness of water. That is an appearance rather than a fact, however; a specimen may be nurtured by a neighboring stream, or the moisture on which it lives may be drawn from a considerable distance. Coville mentions seeing a honey mesquite root that had been exposed by a freshet for a length of 15.8 meters, or over 50 feet, and its smaller end was still half as large in size as where it joined the tree. Such long growth underground, as well as the sand dune practice of swallowing living trees, accounts for the fact that in Death Valley much of the firewood is secured by using a shovel instead of an ax. Those who know the desert look on the mesquite as a sure sign of the presence of water, but the water may be fifty feet down.

Shrubs

Allenrolfia occidentalis—Iodine bush; 2 to 4 feet high; short spikes of scale-like leaves. Common on salt flats where no other species grows.

Atriplex lentiformis—Quail brush; wide-spreading, 6 to 10 feet high, and broader than high.

Atriplex parryi—Parry saltbush; densely branching, white, scurfy, rounded bush, 8 to 16 inches high.

Baccharis sergiloides—Squaw waterweed, *guatamote;* shrub, 3 to 7 feet high; has a sticky exudation; reputed to be a water purifier.

Pluchea sericea—Arrow weed; 6 to 15 feet high; flowers purple, or whitish tinged with purple.

Salix longifolia—Longleaf willow; 5 to 15 feet high; foliage bright green, or in lower elevations where found in Death Valley yellowish green; leaves narrow and 2 to 5½ inches long.

Perennials

Agrostis verticillata—A low-growing grass.

Andropogon macrourus—A hollow-stemmed grass found in wet ground. (*Andropogon glomeratus,* Jepson's *Manual.*)

Anemopsis californica—Yerba mansa; 6 inches to 2 feet high; small spikes of small greenish flowers; stems hollow and rather thick; hairy; leaves from 2 to 10 inches long, partly sheathing the stem. Said to have a spicy herbage and root. This plant was used by the Mexican-Californians in early days as a liniment and a tea.

Apocynum cannabinum—Indian hemp; erect stalks, 2 to 4 feet high; small white flowers in clusters. Jepson notes that this plant is poisonous to cattle. Stalks have a strong fiber, and this may have been the plant used in making cords for rabbit nets.

Chara foetida—An aquatic plant, growing in stagnant waters, fresh or salt; single or parallel tubular stems. Sometimes completely covers muddy bottoms.

Cladium mariscus—Twig rush, saw grass; rough-margined leaves; plant 6 to 10 feet high; stems numerous.

Distichlis spicata—Salt grass.

Eleocharis rostellata—Spike rush.

Elymus triticoides—Wild rye.

Epipactis gigantea—Stream *orchis;* 1 to 4 feet tall; handsome tremulous flowers, pinkish or rose, veined with maroon or purple.

Fimbristylis thermalis—Many stems from a close-set center at ground; 1 to 2 feet high; found near hot springs.

Imperata hookeri—A grass bearing a long spike-like head.

Juncus balticus—Wire rush; 1 to 3½ feet high.

Juncus cooperi—Desert rush; stout stems, 2 to 4 feet high.

Lythrum album—(*Lythrum lineare*), loosestrife; white flowers.

Nitrophila occidentalis—Low-growing, smooth-leaved herb, with a thick taproot.

Panicum crusgalli—Panic grass.

Phragmites vulgaris—Reed.

Ruppia maritima—Ditch grass; plants 2 to 3 feet long.

Schoenus nigricans—Black galingale; 10 to 20 inches high; rigid, prickly-tipped leaves.

Scirpus americanus—Bulrush, slender stems, up to 2 feet high.

Scirpus lacrustis occidentalis—(*Scirpus acutus,* Jepson's *Manual*), common tule.

Scirpus maritimus—Club rush, 1 to 3 feet high.

Scirpus olneyi—Bulrush, 2 to 5 feet high.

Sisyrinchium bellum—Blue-eyed grass, grass iris; low slender perennial, 10 to 20 inches high, usually blue flowers.

Solidago spectabilis—Form of goldenrod.

Sorghum halepense — (*Holcus halepensis,* Jepson's *Manual*), Johnson grass.

Sporobolus airoides—Bunch grass, alkali saccaton; considered an indication that good water is to be found not far below.

Sporobolus asperifolius—Form of bunch grass.

Sporobolus depauperatus — (*Muhlenbergia squarrosa,* Jepson's *Manual*), rush grass.

Suaeda suffrutescens—Woody stems, 1½ to 3 feet high.

Typha angustifolia—Cat-tail.

Annuals

Chenopodium murale—Pigweed.

Chloris elegans—Form of grass.

Heliotropium curassavicum—Chinese purslane (pursley).

Malva parviflora—Cheeseweed.

Melilotus indica—Yellow melilot; form of sweet clover.

Polypogon monspeliensis—Beard grass.

Sonchus asper—Spiny-leaved sow thistle.

Trisetum barbatum—(*Bromus trinii,* Jepson's *Manual*), Chilian brome grass.

DEATH VALLEY PLANTS GROWING IN DRY SOIL

Shrubs

Amphiachyris fremontii—A low bush, 1 to 2 feet high, leaves not hairy, bark white after first season, flowers yellow.

Aster mohavensis — (*Aster tortifolius,* Gray), Mohave aster; leafy stems 1 to 2 feet high; bark white; large handsome lavender flowers.

Atriplex canescens—Shad scale, salt brush; shrub 1 to 5 feet high, gray, rounded.

Atriplex hymenelytra—Desert holly; one of the prize productions of Death Valley, though its value is in its beauty alone. There are considerable arid areas where it is the only plant commonly visible.

Its silver-gray or whitish foliage harmonizes with the harsh surroundings. Its bright red berries, in their season, contrast sharply with the sober lightness of the compact bush. The sprays make up into wreaths as beautiful as the genuine holly, though different in color. It has the disadvantage of a somewhat unpleasant odor. *Hymenelytra* seems to find its perfect habitat in Death Valley, for there is seldom seen in any other region such a prevalence of the plant, or a specimen of such size. An accompanying photograph (facing page 76) proves that it sometimes grows breast-high in those surroundings. The bush branches compactly from a thickened wood base.

Atriplex polycarpa—Cattle spinach, greasewood; light gray, 2 to 3½ feet high.

Bigelovia teretifolia—Shrub, dark green, 1 to 3 feet high, resinous, leaves cylindrical, flowers yellow.

Dalea fremontii—Frémont dalea; small purple flowers, bush 1 to 3 feet high.

Echinocactus polycephalus—Niggerhead cactus; see illustration (facing page 76).

Encelia farinosa—Brittle bush, bush sunflower; 1 to 5 feet high; foliage gray-green; large flowers with yellow rays and orange centers.

Ephedra nevadensis—Joint pine.

Eucnide urens—Bush 1 to 2 feet high, herbage covered with stinging hairs and bristles, some barbed, some straight; yellow flowers.

Franseria dumosa—Burro weed, sand bur; 10 to 20 inches high, foliage grayish.

Hymenoclea salsola—Spreading bush 1½ to 3 feet high, leaves sparse, flower stems often weighted down with the seed clusters.

Larrea tridentata—Creosote bush; the most common shrub on the desert; evergreen, resinous, small yellow flowers; general appearance dark green; 2 to 5 feet high; sometimes called greasewood.

Opuntia basilaris—Prickly pear; large, showy, deep pink flowers; joints fleshy, sometimes an inch thick, somewhat heart-shaped, several inches long. We are informed that this plant is serviceable as a water purifier when crushed and thrown into suspected water.

Opuntia echinocarpa—Cactus, 3 to 5 feet high.

Peucephyllum schottii—Pigmy cedar; much branched, 3 to 9 feet high; leaves needle-like, flowers yellow.

Phellosperma tetrancistra—Fish hook or pincushion cactus; 4 to 10 inches high; pinkish flowers; fruit or berries smooth and pink.

Salvia mohavensis—Shrub 1 to 2 feet high, blue flowers.

Photo by Padilla

Sand dunes

Photo by Willard

The Devil's Golf Course

Sphaeralcea munroana—This variety, listed by Coville as found near Furnace Creek Ranch, is not included in Professor Jepson's *Manual,* though he notes other varieties as existing in the Panamint Mountains. Large salmon-colored flowers; an exception among desert plants in growing in close company.

Perennials

Boerhaavia annulata—Stout stem, 1 to 3 feet high; small flower clusters terminating the branches.

Cladothrix oblongifolia — (*Tidestromia oblongifolia,* Jepson's *Manual*); white woolly plants 9 to 15 inches high and 1 to 3 feet broad.

Cryptanthe racemosa—Small white flowers, profusely branched stems, ½ to 2 feet high.

Cucurbita palmata—Coyote melon; trailing stems several feet long, bearing gourds about 3 inches in diameter.

Eragrostis purshii—(*Eragrostis caroliniana,* Jepson's *Manual*), grass form.

Erigonum inflatum—Desert trumpet, bottle plant; light bluish-green hollow stalks, 2 feet or more high, having prominent enlargements; leaves forming rosette near base; small white flowers at ends of stems.

Euphorbia polycarpa—Plant growing in mat-like form on ground, 2 to 11 inches high.

Hofmeisteria pluriseta—Bushy plant, 1 to 2½ feet high, many whitish flowers.

Lupinus ornatus—Low-growing shrubby lupine; shining silvery foliage, flowers purple, with yellow spot in upper petal.

Nicotiana trigonophylla—Indian tobacco; 1 to 3 feet high; leaves hairless; small, trumpet-shaped white flowers.

Oenothera cardiophylla—Of the evening primrose family, stems 1 to 2½ feet high, petals yellow, aging to brick red.

Petalonyx thurberi—Sandpaper plant; 1 to 3 feet high, thickly branched; greenish-white flowers in short spikes or heads.

Physalis crassifolia—Form of wild groundcherry.

Psathyrotes ramosissima—Densely leafy plant, 2 to 6 inches high and 3 to 12 inches broad; turpentine-scented.

Ptiloria exigua — (*Stephanomeria exigua,* Jepson's *Manual*); stout stems, much-branched near base, ½ to 4 feet high; few flowers.

Sieglingia pulchella—(*Triodia pulchella,* Jepson's *Manual*); low tufted grass, the stems of which take root on bending far enough to touch the ground.

Stipa viridula—Sleepy grass.

Viguiera reticulata—White-barked stems, forming a loose, bushy plant 1 to 4 feet high, few-leaved, flowers yellow.

Annuals

Abronia villosa — Sand verbena; stem pinkish, sticky, hairy; leaves light bluish-green; small, pinkish, lilac flowers in clusters.

Achyronchia cooperi — Prostrate plant, small leaves radiating from the crown of a slender root.

Amsinckia tessellata—Leaves with stiff hairs; small orange-yellow flowers; 1 to 2 feet high.

Antirrhinum filipes—Snapdragon; small, bright yellow flowers.

Atrichoseris platyphylla—Tobacco weed; leaves 1 to 3½ inches long.

Chaenactis attenuata — Freely branching stems 6 to 12 inches high; white flowers, tinged with purple.

Chorizanthe brevicornu—Leaves mostly in a rosette at base of stem; flowers white; excessively fragile.

Chorizanthe rigida—Often found on driest stony hills, where there is little or no other vegetation; 1 to 3 inches high, sometimes forming a spiny mat several inches broad; yellowish flower. Sometimes found on pebble beds which become so hot in the sun that ordinary plants would soon be baked.

Emmenanthe penduliflora—Whispering bells; stem 8 to 21 inches high; flowers cream color or yellow. Erect when they first bloom, the flowers gradually droop and retain their shape when dry. Their faint rustling when shaken by the breeze gives the common name.

Erodium circutarium—Red-stem filaree.

Eschscholtzia minutiflora—Smaller than the *Eschscholtzia californica* or California poppy.

Filago californica—Stem 4 to 15 inches high; herbage covered with white hairs.

Gilia filiformis—Small yellow flowers.

Gilia latifolia—Coarse plant 3 to 13 inches high; broad, coarsely toothed leaves.

Lepidium lasiocarpum—Pepper grass.

Leptosyne bigelovii—Desert coreopsis; yellow flowers with orange centers; stems 8 to 14 inches high.

Macrocalyx micranthus—(*Ellisia micrantha,* Jepson's *Manual*); erect stems, 5 to 10 inches high; white, bowl-shaped flowers.

Malveopsis rotundiflora—Spotted mallow.

Mentzelia albicaulis—Slender stem, 3 to 12 inches high, commonly white; flowers yellow.

Mentzelia reflexa—Desert canyon growth, 5 to 8 inches high, saw-edged leaves, which become brittle and with bristles which enable them to cling tightly to clothing.

Mohavea breviflora—Sulphur-yellow flowers; plant 3 to 5 inches high.

Nemacladus ramosissimus—Many stems, pinkish-white flowers, small.

Oenothera brevipes, Oenothera refracta—Yellow flowers; *Oenothera scapoidea,* white flower changing to pink. All belonging to evening primrose family.

Oxystlis lutea—Stout, erect stem, often a yard high; discovered by Frémont near the Amargosa River.

Pectocarya linearis—Low plant, narrow leaves; small white flowers.

Perityle emoryi nuda — Wide-spreading branches, herbage ill-scented, small yellow flowers.

Phacelia crenulata—Wild heliotrope; 6 to 12 inches high; purplish stems; coarse foliage, hairy and sticky; flowers lilac, with purple stamens and pistil.

Phacelia fremontii—Several stems, 6 to 12 inches high, lilac-blue or lavender flowers with yellow throats.

Phacelia pachyphylla—Dwarf plant 1½ to 4 inches high, purple flowers.

Piptocalyx circumscissus—From 1½ to 7 inches high, small white flowers.

Plantago patagonica gnaphaloides—Of plantain family; foliage white with silky wool; spike dense and woolly.

Pterostegia drymarioides—Several stems, a few inches to 1½ feet long; small reddish flower.

Salvia columbariae—Chia; stout purplish stem, 6 inches to 2 feet high; leaves dull green, much wrinkled; sage odor; button-like clusters of bright blue flowers. The seeds have food qualities, for which the plant was cultivated in ancient Mexico. The seeds, used by the Indians, were roasted, ground, and mixed with water; they are said to have a taste like linseed meal and to be highly nutritious. They are probably best known for their reputation as a water purifier.

Sisymbrium canescens—(*Sisymbrium pinnatum,* Jepson's *Manual*), Tansy mustard.

Stylocline micropoides—White, woolly, 1½ to 7 inches high.

The author is under obligations to Mr. Robert Kessler, of Los Angeles, for the following list of ferns found in Panamint range canyons on the Death Valley slope; brief descriptions are added.

FERNS IN PANAMINT RANGE CANYONS

Cheilanthes covillei—Coville's lip fern; tufted stalks 2 to 6 inches high.

Cheilanthes viscida—Viscid lip fern; 3 to 12 inches high.

Notholaena jonesii—1½ to 4 inches high; leaflets few.

Notholaena parryi—Cloak fern; plants 2½ to 8 inches high; fronds ¾ to 4 inches long, leaflets sometimes resembling pellets of wool.

Pellaea breweri—Sierra cliff brake; plants densely tufted, 3 to 8 inches high, stalks red-brown.

Pellaea ornithopus—Bird's-foot fern; sometimes called poison fern because of causing death to sheep which eat it; 7 to 17 inches high, evergreen, brittle; mahogany-colored, wiry stalks, fronds bluish or lead color.

The author is specially grateful to Professor W. L. Jepson for reading the foregoing manuscript and making such corrections as were necessary. His services as professor of botany in the University of California, as president of the California Botanical Society, and as author of the standard *Manual of the Flowering Plants of California*, as well as other publications, give his verdicts the highest authority.

He writes:

> There ought to be a new Death Valley list. The botany of the Death Valley Expedition will always be useful, but it is now somewhat antiquated. My own field books contain many additions to the Death Valley plant list, but it would take a lot of time to make a new list—so many, many specimens would have to be carefully determined.

Professor Jepson kindly supplies the following additional notes, made during his own excursions into that region:

Even in the driest years the Funeral Mountains, looking so black and forbidding, afford many interesting plants. Two rushes, *Juncus cooperi* and *Juncus mexicanus,* grow in moist alkaline swales, as does also *Pluchea sericea,* the arrow bush, while the grass *Sporobolus airoides* is found about springs. On the dry slopes we have such shrubs as *Bebbia juncea,* which has a multitude of stems from the base forming a broad bush resting on the ground; 2 to 2½ feet high and 3 to 5 feet broad. Another bush of these arid slopes is *Hofmeisteria pluriseta,* whose multitudinous stems form a dense interwoven bush 2 to 2½ feet high. The blade of its leaf is almost minute, with very long petiole.

A feature of the Furnace Creek wash, as in most washes throughout the region, is *Peucephyllum schottii,* which, with its bright, deep green crowns, though no more than a bush about 5 feet high and usually somewhat broader, gives nevertheless an almost park-like effect to certain turns of the flood-stream bed. It has some slight suggestion of being arboraceous because of having but a single trunk. It was named after Arthur Schott, one of the scientific staff attached to the Mexican Boundary Survey of 1850. In the shadow of the great rocks one finds a solanaceous plant, *Physalis crassifolia,* with buckskin yellow flowers, and on the canyon walls *Salvia funerea,* and still another loosely growing but erect shrub, *Viguiera reticulata.* Of course the common *Franseria dumosa* is frequent in the wash for many miles as well as out on the dry hills. *Dalea mollis* also grows in the wash.

One of the remarkable features of the region is a certain number of endemics. When on a long tramp down the Furnace Creek wash, my first trip down it, watching eagerly for the rare plants of the region, I saw a single individual of *Phyllogonum luteolum* about two inches high, a species known only from Death Valley. I took it and put it in my press, expecting to find enough of it, and went on down the wash. Within perhaps two hundred or two hundred and fifty yards I suddenly woke up to the fact that I was not finding any more, and so returned to the original spot, locating it with much difficulty. Whereupon I set up my plant press as a marker and carefully cast around the spot at an ever increasing distance for nearly an hour in the hope of finding other individuals, but failed. Nor did I on subsequent days find any more either there or elsewhere. There were, however, considerable quantities of somewhat common things, such as the prostrate plants of *Eremiastrum bellioides* with their daisy-like flowers, *Chorizanthe rigida,* a xerophytic annual, and *Phacelia calthifolia,* this last favoring moister ground. Out upon the dry slopes of

the Funeral Mountains I found a few scattered individuals of a singular endemic of the buckwheat family, namely *Boerhaavia annulata,* a slender-stemmed plant with glandular bands about the middle of the joints.

One of many interesting experiences was a trip down the Valley floor to Eagle borax works, where we parked our machine and loaded commissary and scientific supplies on the backs of donkeys for a journey up into the Hanepah Canyon of the Panamint Mountains. The wash in the lower bottom of the canyon has a number of herbs and shrubs which I enumerated in my field book:

Psathyrotes ramosissima
Viguiera reticulata
Physalis crassifolia
Eucnide urens
Peucephyllum schottii
Bebbia juncea
Stephanomeria runcinata
Franseria dumosa
Atriplex hymenelytra
Larrea tridentata
Boerhaavia annulata
Mohavea breviflora
Aster tortifolius
Chorizanthe rigida
Dalea johnsonii
Encelia farinosa

We went into camp at a fork of the canyon at an altitude of 4,000 feet. It was a delightful spot, with a great abundance of vegetation, not only in the moist canyon bottom where flowed a brawling stream but also out on the open slopes and canyon walls. One of the choice shrubs at this place, a member of the rose family, is *Cowania stansburiana,* a bush 9 feet high, straggling or spreading, with twisted branches, but almost every inch of its surface covered closely with blossoms of a dull but even white. *Baccharis sergiloides,* a water indicator, is often common and in places abundant, standing 4 to 6 or 7 feet high. The crimson flowers of the little herb *Mimulus bigelovii* adorn the sands of the wash, while *Salvia carnosa* is in full flower, with its rich blue giving color to the hill slopes. *Brickellia multiflora,* with its slender stems 4 to 8 feet tall, is something of a botanical find, as well as *Pentstemon fructiformis.* One of the striking tangles of growth in the canyon bottom was represented by the native desert grass and near it the clematis, *C. ligusticifolia,* clambering over the willows and trailing about generally along the stream. A short distance above camp the canyon bottom is filled with a heavy growth of the desert grape, *Vitis girdiana.* The stems were 5 to 20 feet long. In certain places the vines extended up the canyon walls on moist slopes.

The top of Telescope Peak is visible from here, and one day I climbed to its snowy summit in order to study the pines on its upper

slopes. First comes the piñon, *Pinus monophylla,* and above the piñons a solitary juniper tree, with two pines, the limber pine and the hickory pine, growing on the upper slopes of Telescope Peak. It was on this trip, at about 7,500 feet, that I discovered a new loco weed, which I have named *Astragalus jucundus* on account of its very pleasing and abundant light-purple flowers. Its brown-spotted pods were markedly inflated.

I discovered a number of entirely new species in the region, as well as a very considerable number of additions to the Death Valley flora itself.

A remarkable plant which deserves special notice, perhaps, is *Enceliopsis argophylla,* var. *grandiflora,* which grows near one of the Valley entrances not far from Wildrose Springs. Its thick caudex, silvery leaves, and large heads of yellow flowers make a very striking spectacle where it grows.

Professor Jepson's suggestion that there should be a new Death Valley list receives emphasis from an enumeration kindly supplied by Mr. Kessler, who adds many to the names contained in the foregoing. Common names have been added, in the few instances where they are known, in giving his additions:

Abronia exalata
Abronia turbinata
Amelanchier alnifolia (Western service berry)
Anemone tuberosa
Arenaria aculeata
Asclepias erosa (Desert milkweed)
Atrichoseris platyphylla (Tobacco weed)
Atriplex parryii (Parry saltbush)
Atriplex phyllostegia
Atriplex torreyii (Water sage)
Brickellia knappiana
Calochortus kennedyi (Desert mariposa)
Canbya candida
Chamaebatiaria millefolium (Desert sweet)
Chenopodium fremontii
Coreopsis bigelovii (Desert mariposa)
Cymopterus panamintensis
Dicoria canescens

Encelia actoni
Ephreda viridis
Ericameria paniculata
Ericameria teretifolia
Eschscholtzia glyptosperma
Eurotia lanata
Geraea canescens (Desert sunflower)
Grayia spinosa
Gutierrezia lucida
Hermidium alipes
Hesperocallis undulata (Desert lily)
Kochia americana (Red sage)
Malva parviflora (Cheeseweed)
Mentzelia albicaulis
Mentzelia reflexa
Monolepis spathulata
Monoptilon bellidiforme
Monoptilon bellioides (Desert star)
Oxytenia acerosa
Phacelia calthifolia
Phacelia cryptantha
Phacelia distans
Phacelia pedicellata
Phacelia perityloides
Philibertia hirtella
Plantago xerodea
Prunus andersonii (Desert peach)
Psilacis coulteri
Sarcobatus vermiculatus (Black greasewood)
Scopulophila rixfordii
Solidago guiradonis
Solidago nevadensis (Goldenrod)
Sphaeralcea eremicola
Sphaeralcea munroania
Sphaeralcea pulchella
Sphaeralcea rotundifolia
Wyethia ovata

VII. ANIMAL LIFE

Contrary to sundry pronouncements of the misinformed, animal life in Death Valley is emphatically not "confined to the most repulsive forms, such as the lizard and rattlesnake, scorpion and tarantula, the horned toad, in some months gnats, a few blackbirds and crows." Rattlesnakes are not at all plentiful. One of the entomological expeditions into Death Valley reported finding only one scorpion, well up in the Panamint Mountains, and did not mention a single specimen of either centipede or tarantula. Sydney H. Ball, of the Geological Survey, said that mosquitoes and similar pests occurred only near some of the larger water holes. But whatever there may be of those forms of life, there are numerous other forms as well.

North American Fauna, No. 7, the report of the Death Valley expedition of 1891, listed 78 different species of birds or fowls, with the observation that the list is believed to be reasonably complete, since the Valley was visited by one or more members of the expedition every month except May from January to June inclusive. Yet, as will be seen later, the enumeration was far from being complete. This listing included: mallard, baldpate, green-winged teal, cinnamon teal, pintail, ruddy and shoveler ducks; eared grebe, Virginia rail, white-fronted goose and a subspecies, white-faced glossy ibis, night heron, coot, Wilson's snipe, Wilson's phalarope, kildeer.

These water birds were observed principally at Furnace Creek Ranch; a few were seen at Saratoga Springs, in the southeastern extension of Death Valley.

Among predatory birds, the expedition found turkey buzzard, marsh hawk, sharp-shinned hawk, Cooper's hawk, western redtail, prairie falcon, pigeon hawk, desert sparrow hawk, osprey, raven.

Gambel's quail is the species found at Furnace Creek. Naturalist Joseph Grinnell theorizes that the birds were

introduced by the borax company, while Spears, writing in 1891, credits "Bellerin'" Teck with planting them, which would make their tenancy several years longer.

The mourning dove is a common bird in the Valley.

The road runner and the burrowing owl are there, as is naturally expected. Of smaller bird life there are many species, including California cuckoo, kingfisher, red-shafted flicker, whippoorwill, western nighthawk, Texas nighthawk, white-throated swift, Costa's humming bird, ash-throated flycatcher, Say's phoebe, black phoebe, Wright's flycatcher, cowbird, yellow-headed blackbird, red-winged blackbird, western meadowlark, Bullock's oriole, Brewer's blackbird, house finch, six varieties of sparrows, lazuli bunting, tree swallow, rough-winged swallow, white-rumped shrike, least vireo, Audubon's warbler, western yellowthroat, long-tailed chat, titlark, sage thrasher, Le Conte's thrasher, mockingbird, rock wren, canyon wren, Baird's wren, tule wren, ruby-crowned kinglet, western gnatcatcher, western robin, mountain bluebird.

While the foregoing is comprehensive enough to prove that Death Valley has many varieties of bird life, it falls far short of the results of an investigation by Dr. Joseph Grinnell in April and May 1917 and May 1920, reported in the *Proceedings of the California Academy of Sciences* for 1923. Dr. Grinnell found 124 species of birds in the Valley. He lists 24 species as but casual visitors, 45 as regular transients, 32 as winter visitors, 10 as summer visitors, and 13 as permanent residents. Those that have adopted the desert as their own are prairie falcon, burrowing owl, road runner, western raven, English sparrow—a rather hard lot of citizens so far, but improved by the Say phoebe, kildeer, desert quail, meadow lark, California linnet, Le Conte thrasher, and rock wren. His investigations led him to say that only 7 per cent of the birds breed outside of the precincts of the Furnace Creek Ranch. He counted 544 specimens at the ranch in eight hours.

At other points, he found six birds in two and one-half hours near Bad Water, 10 in the same length of time six miles south of the ranch, 24 birds in two and one-quarter hours near Triangle Spring, 52 in four hours near Salt Creek, 22 in two and one-half hours west of the ranch, and 154 in two hours north and west of the ranch. He notes:

> The mesquite association is most prolific of bird life. The mesquite harbors an abundance of insects, the foliage and beans are edible for some birds, and it affords shade and protective cover to a better degree than other native plants.
>
> Mr. Oscar Denton [then caretaker at the ranch] told me there are many more ducks in evidence during the southward migration in July and August than when they are going north in spring. There are then literally thousands. That is probably the special harvest time for the Indians, for he remarks: "The birds are killed by the Indians, who know no game laws." The cinnamon teal is the most frequent species in spring. That species and others arrive during the night and are loth to leave by day.

Spears, in *Sketches of Death Valley,* contributes to stories of wild fowl in Death Valley:

> The most interesting fact noticed about the wild fowl of the desert was the trouble they had when they settled in certain waters there. Because water is scarce in the region, the smallest ponds, even the crystallizing vats at some of the borax works, attract them. In some of the vats they will remain swimming about all night; if the night is cold they often remain longer, whether they wish to or not, for the crystals form so rapidly at such times that when morning comes the unfortunate birds are so weighted down with crystals they cannot fly. Although I did not see this, there is no doubt of the fact, for I was told of it by Mr. F. M. Smith, and others confirmed the story.

Lieutenant Birnie, in his report of his trip in 1875, said:

> The highest part of the range [the Funerals] is a resort for Indians, who gather the pine nuts in the fall. Here was also observed the peculiar blinds made by the Indians just beside the springs for

killing the birds—quail and some very small varieties—that come in numbers to the only water to be had. These blinds have the general appearance of a beehive, are made of rushes and small boughs interlaced, with an opening for entrance on the side away from the spring. The interior is large enough to seat one person, a small opening being toward the water through which to shoot the arrow with a string attached for recovering it, so no alarm is produced.

This is confirmed by Mr. E. H. Ober, who spent much time in that region studying the mountain sheep. He states that hardly a spring is without its blind, and that sheep as well as birds were shot from that cover.

Noblest among the quadrupeds found in Death Valley and its watershed is the mountain or desert sheep. This species is now protected by law, and this has done something toward preventing extermination of the animals by the white slayer with his field glasses and long-range rifle. A diminishing Indian population, rather than respect for the white man's law, may account for there being fewer sheep in Indian camp kettles than in former years. Spears records that in 1891 thirty were killed by the natives in a big drive for which there was much preparation. Stone walls for blinds were built at a number of places along the runways in the hills, he says, and the handful of prospectors in the region were much alarmed thereby. To their minds, the walls were fortifications for defense of supposed mines of great value. The story was published, and by the time it reached the papers of St. Louis the stones were said to have been laid to a height of thirty feet. The purpose related to mutton and not money, however, and when the Indians brought their game into the camps the excitement quieted down.

A magazine writer whose statements, like our own on this subject, are not based on his own observations says:

Their color varies with the season and the locality which they inhabit, ranging from pale gray or brown to dirty white. The rump patch and part of the hams are white, as is their belly. The breast

sometimes is brownish but often is gray. Hunters who killed them before they were given sanctuary declare that the meat is delicious, being sweeter and more palatable than venison.

Much has been printed about these sheep that is pronounced incorrect by Mr. E. H. Ober, Fish and Game Warden of Inyo County, who has spent many weeks in their native habitat, learning probably more about them than any other person. What follows regarding these sheep is from notes kindly supplied by him.

The origin of the species was probably by immigration from the Old World, via the ice trail of Bering Strait, the ancestors being the Marco Polo sheep and argali of Asia. One variation or another of the animals is found all the way from Alaska into Mexico. The variety distinguished by scientists as Nelson Death Valley sheep, *Ovis nelsoni,* are really the bighorns of the Rockies, somewhat modified by their environment and food. They are not found in California north of Convict Lake, Mono County, or in Nevada north of Mount Montgomery, but they inhabit every mountain range in the Death Valley region.

In days before the white men came, the sheep crossed to the Sierra, as mule deer still do, but, Mr. Ober observes, no instance of a mountain sheep so crossing has been reported within fifty years. The desert sheep are believed to be identical with those of the Sierra, though differences in environment make the Sierra sheep lighter colored. The total number in all the ranges of eastern and southeastern California has been estimated at 3,000, and in recent years the numbers have increased.

The young of all California mountain sheep are born in May or June, each mother almost always bearing two. Their cradles are the roughest places imaginable, a choice attributed to the desirability of the lambs being able to keep beyond reach of their foes. The lambs remain for a few days where they are born, but are able at a very tender age to follow their dams wherever the latter may lead. The

youngsters remain pure white for some time before taking on the color of the ewes or the darker shade of the rams. Their natural life span is about sixteen years, controlled somewhat by range conditions.

One of our best-loved mountain authors has written of the covering of the wild sheep as "wild wool." This is wholly inaccurate. The hide and hair are practically the same as those of the mule deer, and do not in any way resemble the wool pelt of the common sheep. A mountain sheep's eyes are not jet black in color, as nature fakers have asserted. They are dark yellow.

While not resembling the domestic sheep in any other way, the wild species has similar feeding habits. They thrive under almost all conditions because of ability to feed on practically any growth found in their domain, and are perfectly at home among the cacti and yuccas. During the hot days they take shelter under sheer cliffs, feeding from daylight until mid forenoon, and from about 4:00 P.M. until dark. When green feed is available they seldom come to water. In the driest months of midsummer they water twice a week, and it was at such times that they fell victims to the Indians in their blinds. There are succulent roots (said to be those of the Matilija poppy) which seem to act as a thirst-quencher, and in dry weather they dig these out. The use of the horns for such digging among the rocks is the explanation why those of nearly all the older rams are broken at the tips; and the ewes usually have tender feet from using their hoofs for a like purpose.

They are bold and reckless climbers, capable of feats of endurance that are astonishing. It is not at all unusual for them to travel twenty miles to water and to feed back to their regular haunts. Tales of the animals jumping from a height and lighting on their horns are unfounded. They can do wonderful climbing and jumping, touching here and there on appalling declivities, and landing right side up and

ready to continue their flight. They are alert, but have a sometimes fatal degree of curiosity. When once thoroughly alarmed they will go until other rough country is found, whether it be one mile or twenty.

Desert sheep, especially the lambs and young rams and ewes, are very playful. The sight of a herd at play, not alarmed or suspicious, is one to be remembered.

Their hoofs are perfect for their necessities; somewhat long and narrow, cupped, with sharp edges, and having inside near the heel a rubber-like substance that serves as a brake on steep inclines. While they are travelers on occasion, they move little in spring and early summer when there are plenty of grasses and wild flowers. When such supplies thin out, they are constantly on the move, nearly always remaining at higher elevations.

Though having keen sight and scent, their hearing is very poor, owing to their small ears being commonly filled with a species of tick which thrives there almost from the time of their birth.

During the rutting season the animals gather in large bands and afterward scatter, the rams on their solitary way and the ewes and young sheep associating in bunches throughout their range. At that season there are many brief but conclusive combats among the rams. Two rivals, meeting on a level spot, will back off a few feet apart, then come together with a crash. The force of the impact sometimes throws both contestants upright on their hind feet. Two or three such lunges are usually sufficient for the loser, who runs off at top speed without waiting to battle to a finish. Examination of a specimen will show that in such a fight it would be impossible to break the horn tips, which, as already said, are damaged in digging for food.

The dressed weight of a specimen seldom runs over 160 pounds, including perhaps 25 to 30 pounds for the head and horns. The ewes are smaller. No other American wild animal has circling horns. Though tales are told

of horns 18 or 19 inches in circumference at the base, it is doubted if a single specimen, living or dead, can be produced with basal horn measurement so large. The ewes have straight horns, about 10 inches long. Mr. Ober secured for Dr. W. T. Hornaday, the eminent naturalist, the group of Death Valley sheep specimens now on exhibition in New York, and while so doing took various measurements of one of the animals, a ram twelve years old. They were as follows: Weight of specimen, dressed, 154 pounds; circumference of horns at base, 15½ inches; length along outside curve, 40¼ inches; widest spread, 21 inches; weight of dry skull and horns, 34 pounds; distance between tips of horns, 18 inches; height of animal at shoulders, 39 inches; length of head and body, 65 inches; girth behind foreleg, 50 inches; girth at middle of body, 54¼ inches.

The worst natural enemy of the mountain sheep in the Death Valley region, as elsewhere, is the golden eagle. These birds are found in most of the mountain ranges and in that almost treeless country build their nests among the cliffs. Part of their living comes from the sheep, the young lambs being frequently attacked. Mr. Ober found the skulls of four young sheep near an eagle's nest, and with his companions witnessed the killing of a five-months-old lamb by two eagles. The animal being rather large to carry off, the eagles swooped down repeatedly and drove their talons into its back, finally killing it. The eyes and softer parts of the body are first picked out for food.

Wildcats and lynxes are occasional visitors, if not residents of Death Valley; five cats and a lynx are said to have been killed by Cub Lee at the Furnace Creek Ranch. The coyote is not unknown in the region, but is less common than in the deserts all around. Badgers, jackrabbits, cottontails, mice, rats, gophers, skunks, and foxes are occasionally seen.

An interesting denizen of the desert is neotoma. Should you miss, from your camp on Furnace Creek, a spoon or

Photo by Padilla

Wild burros in Death Valley

Photo by Clatworthy

Harmony Borax Works

some other small property, it is not necessarily an indication of human thievery. Neotoma may have paid you a visit; if so, he has left his card, in the form of a bit of stone or some other trifle. For neotoma is the musical name bestowed by naturalists on the pack rat, or trade rat. He is a prankish little scamp, with a certain instinctive honesty which prompts him to replace what he takes away, leaving any bit of trash that is handy. One writer accounts for his exchanges by the theory that the "rat" carries with him whatever suits his fancy, dropping it when something more attractive is seen. That hardly explains; one cannot credit the little creatures with making a business of lugging sticks and stones to no purpose. Many incidents of trade-rat activities are related; none among them surpass the feat of carrying off one hundred and eighty sacks of grain, as told in an earlier chapter (page 9).

Despite the name commonly given him, neotoma is said to have no family connection with the house rat. He will not remain in a habitation when the other species appears, though he makes it his business to drive off other small rodents. He is credited with being a friendly, engaging beast, easily tamed.

A notable instance of adaptation to circumstances is the use of the cactus for defensive purposes by the trade rat. It is said that after this animal makes its nest of sticks, stones, and whatever may be handy for its architectural purposes, it protects the nest by a barrier of cactus joints, guaranteed to repel any snake or other invader. How the tender-skinned neotomas manage to thread their way safely through their own defense is a mystery. A like observation applies to the cactus wren, whose habitation in the midst of a thorny clump assures safety from predatory birds and animals.

The kangaroo rat is another inhabitant of the region. Naturalist Hornaday describes it as one of the most beautiful and attractive of all native rats. "Apparently they

are both fireproof and waterproof, for no amount of heat affects them, and the absence of water does not seem to depress their spirits in the least," Hornaday remarks in his *American Natural History*. The common name is given because of their long hind legs, on which they hop, holding the forepaws close to the body. The tail is longer than the small body; and there are accounts of cruel men who amputated the tails of captured specimens to get amusement from their crippled locomotion without the natural balance. A notable characteristic is the large cheek pouches, used in their commissary operations and for carrying soil from their burrows. A Death Valley resident informs us:

> They have far less fear of mankind than the same animals in other sections. I have placed my foot entirely over a mouse and within half an inch of his head, the mouse gnawing at a kernel of corn and I trying to see how close I could get to him. Not a stir from the mouse; he sat on his haunches and ate corn, occasionally looking me straight in the eye. One kangaroo mouse which made headquarters in a tent I had would take observations as if much interested in what was going on. He would never eat from one's hand, but would watch and wait for a piece of cheese held out to him, if it took a minute or two of his time.

Bats are plentiful in certain localities, according to Dr. S. G. George, whose account of a trip into Death Valley includes the following:

> There is one thing in Death Valley that will sometime be utilized, and that is the guano to be found in caves, deposited by the millions of bats which have their homes there. You could, on a clear evening, hear them coming out, their wings making a noise like a windstorm. The deposits they have made in many places must be immense, as they have used these caves for ages.

So far as shown by available records, reptilian life in Death Valley is limited. An *American Naturalist* report published November 1897 told of the finding of forty-four species of reptiles and twelve species of batrachia (frogs

and toads). The Death Valley Expedition listed only eight forms of lizard, four of snakes, and two of frogs.

Crotalus cerastes, the horned rattlesnake or sidewinder, is the characteristic snake of the Great Basin from southern Utah westward to the California desert boundaries. Though said to be more plentiful in the regions eastward, it is frequent enough in the Death Valley country to keep its existence constantly in mind. Though seldom over eighteen inches in length, it is reputed to be the most dangerous and fatal among the rattlesnakes. Its common name comes from its peculiar mode of locomotion, a movement appearing more broadside than straight ahead as snakes ordinarily travel. Its rattle (not always used) is proportioned to its small size, so that its warning, if given, is not always heard before the victim feels the sting of its fangs. It does not coil in striking, merely elevating its head. Generally the sidewinder is a night rover, remaining in the shade during the day; it is said that if exposed to midday sun it will die in a few minutes. This dangerous little menace is credited with the practice of crawling into bedding if opportunity offers.

Another rattler found in the higher elevations in the Death Valley watershed is the reputedly rare tiger rattlesnake. Nineteen are said to have been killed in a single season in a canyon of the Panamints. The nearest to the Valley floor that we hear of any having been found is on the slope down from Towne's Pass, where two were killed while standing partly erect with their heads near together, apparently playing.

The statement has been published somewhere that a hypodermic injection of sub-bichlorate of potassium is a sure antidote for the bite of the sidewinder and his Death Valley relatives. It was also stated that the remedy had been successfully tested frequently, and that it was recommended by the Smithsonian Institution. An inquiry for confirmation of this assertion brought the reply from the

Institution: "We do not endeavor to prescribe the best treatment for rattlesnake bite."

Unless there are more tarantulas, scorpions, and centipedes in Death Valley than scientific men have discovered, the rattlesnake family seem to be the only dangerous inhabitants, with the exception of an occasional coyote which becomes rabid from the heat and lack of water and thus able to inflict a bite which is said to be unfailingly deadly. Sydney Ball, already quoted, says in his report:

> Rattlesnakes, both the ordinary variety and the peculiar sidewinder, are sometimes seen, but are by no means as common as report would lead one to believe. The same is true of the scorpion and the tarantula.

One of the most fearsome-looking yet harmless objects that may be encountered is the chuckwalla, or chahwalla of the Indians. It is a lizard of exaggerated size, with broad black or blackish body, tail light-colored, sometimes almost white, with dark bars. Dr. Stejneger in the Death Valley Expedition report notes that there are great individual variations in coloration and that the distinctness or presence or sometimes complete absence of tail markings is changeable in the individual and apparently dependent on the intensity of the light to which it may be subjected. It is generally found on dark-colored rocks with which its shades harmonize. It is a favorite dish with the Indians, who are said to eat it as caught, possibly brushing off any adhering sand but doing nothing else in the way of preparation before cooking. Dr. Merriam, of the expedition, noted that "a number were eaten by members of our expedition and their flesh was reported to be tender and palatable." It is vegetarian, feeding on buds and leaves.

One of the Death Valley reptiles is the leopard lizard, which feeds not only on vegetation but also on its own kind if it has opportunity. Even its own offspring sometimes serves it for a meal. One variety, the gridiron-tailed lizard, according to Dr. Stejneger, runs with great swiftness,

Photo by Frasher

A typical "desert rat"

Photo by Frasher

Ryan, California

with its tail curled up over its back as if afraid to let it touch the hot surface of the earth. It starts off at full speed as if fired from a cannon, and stops with equal suddenness, thus escaping or eluding its enemies, the coyotes, hawks, and larger lizards. When running it moves so swiftly that the eye has difficulty in following; and when at rest its colors harmonize so well with those of the desert that it can hardly be seen. . . . . The attitude of this lizard when at rest differs from that of most others in that the knees and elbows stand out at right angles from the body and are elevated to such a degree that they nearly reach the plane of the back. Like many other species, it has an odd habit of performing a singular gymnastic exercise, consisting in rapidly dropping the body with the knees held stiff at right angles to the trunk.

Of all the reptile tribes, the horned toad probably bears the best repute in human circles. He is not a beauty, this broad, flat lizard hardly longer than a baby's hand, and his horns look as though they might have some offensive or defensive value. He lacks the speed of his lizard cousins, and for protection has little else than his coloring, wonderfully blending with the sands over which he moves. One species is credited with a singular defensive plan. Curator Stejneger quotes a letter from Vernon Bailey, naturalist:

I caught a horned toad today which very much surprised Dr. Fisher and myself by squirting blood from its eye. On taking it in my hand a little jet of blood spurted from one eye a distance of fifteen inches and splattered on my shoulder. Turning it over to examine the eye, another stream spurted from the other eye. This he did four or five times with both eyes, until my hands, clothes, and gun were sprinkled with drops of bright red blood. I put it in a bag and carried it to camp, where four hours later . . . . it spurted three more streams from its eyes.

Dr. Stejneger gives another instance of the same kind, in which an examination proved that the liquid was really blood.

Among horned-toad characteristics is said to be that of expeditiously burying itself in the sand, its wedge-shaped head serving as a burrowing tool and its legs as power in

driving ahead, so to speak, while its wiggling body assists the process.

The Death Valley visitor is usually more concerned in keeping insects out of his personal belongings, his provisions and bedding, and away from his person than he is in the number of varieties of them to be found in the Valley. No great annoyance arises on their account, however, for, while those orders of animate existence are by no means lacking, neither are they noticeably abundant.

This statement is borne out by available records of scientific investigations. The most thorough investigation, apparently, was one reported in the *American Naturalist* in November 1897, in which the statement was made that 258 varieties of coleoptera, or forms of the beetle family, had been found, 19 of them new. According to Comstock's *Study of Insects,* the continent north of Mexico contains more than 11,000 varieties of coleoptera; hence Death Valley does not appear to have more than a reasonable allotment. The same work mentions that of lepidoptera, or moths, millers, butterflies, and like insects, there are a total of 6,000 varieties; of flies, "a large order" (the phrase being used in its scientific sense and not slangily, though the latter is appropriate); of hymenoptera (bees, ants, wasps), "very many species"; of hemiptera (bugs, lice, aphis), "many"; and at least enough in each of the other divisions of entomology.

In the saline waters of Salt Creek and Saratoga Springs (reports Park Naturalist Curry) live thousands of "desert sardines," a little top-minnow or stickleback whose scientific name, *Cyprinodon macularius,* is longer than his body. Once living in the huge lake that filled Death Valley thousands of years ago, they have retreated to their present homes as the ancient lake dried up. Some carnivorous water beetles, wading birds, and even coyotes feed on them.

The first systematic study of Death Valley insect life was made by the expedition of 1891, which fell far short

of the 1897 enumeration. Its entomologist reported something over 60 forms of such life, including 28 kinds of beetles, from the floor of Death Valley. This interesting lot of hard-shell residents included four varieties of lady bugs, "kissing bugs," and others. In its catalogue is no mention of the tarantula, or in fact of any spider. Its only scorpion was taken in the Panamint Mountains, location not given.

Few specimens of flies and mosquitoes were taken, and most of them in the higher elevations. There are watered spots where mosquitoes might breed, but as such pests travel only short distances from their places of origin the encouragement of water is rare enough to make mosquitoes scarce in Death Valley. Comstock, however, does not hold that absence of water would prevent their spreading: "The larvae of mosquitoes, so far as they are known, are aquatic, but it is probable that some species breed in the ground, for mosquitoes occur in arid regions far from water."

Among the finds of the expedition of 1891 were ichneumons and other wasps, bees, hoppers, plant lice, an ant sometimes an inch long, and one kind of bug so small that it is a parasite on plant lice. The reader may recall an old rhyme alleging that

> Dogs have fleas upon their backs to bite 'em;
> Great fleas have lesser ones, and so—*ad infinitum.*

This plant-lice parasite is so tiny that in its whole little lifetime it does not move far enough to circumnavigate its Latin name written on paper.

The records of the expedition are admitted to be very incomplete. Beside the specimens listed, many others at the time of publication were in the hands of specialists to whom they had been referred for classification and were not reported in detail. Less is known of the insect life of Death Valley than of any other of its common details. Those who believe that along with its other unpleasant

features it may be found to possess a surplus of bugs may take heart from this quotation from the report:

> There are few parts of the country, however well explored, that will not yield to the entomologist in a few days' collecting a good percentage of species that are new or undescribed. This being true of the older sections of the country, it is true to a far greater extent of such exceptional regions as those included in the Death Valley Expedition.

VIII. GEOLOGY AND MINING

Modifying and scar-concealing influences of water and weather have done comparatively little to hide the violence of volcanism and earth rebuilding in Death Valley.

Geologist Sydney H. Ball (*United States Geological Survey Bulletin 308*) sums up occurrences of ages in this:

In Tertiary, probably early and middle Miocene time, Death Valley did not exist. Amargosa and Panamint ranges were low, and their southern portions at least were covered by a lake which extended well into the present Death Valley south of Salt Creek. In late Pliocene time, however, Death Valley was probably a closed basin, occupied by a sheet of water, which appears to have been a playa. This playa varied widely from time to time in extent and was bordered by the uplifted Panamint and Amargosa ranges..... The inwash of material from the mountains raised the center of the valley hundreds of feet above the present level..... The folding of the Amargosa and Panamint ranges does not alone account for the valley, and it appears to be a block dropped down between the bounding ranges by faults.

J. E. Spurr, no less eminent as a geological authority, had said in *Geological Survey Bulletin 206:*

The succession of events in the Grapevine and Funeral ranges and in the region of Death Valley is about as follows:

1. Deposition of a thick, conformable Paleozoic series.
2. Elevation to land mass, without marked folding.
3. The formation of sharp, lofty mountains, with deep valleys.
4. The deposition of the thick Tertiary series. This took place, in part at least, in a great inland sea. In this lake were deposited near the shores conglomerates and breccia derived from the Paleozoic rocks; in the other portions were formed silts mixed occasionally with gravels..... There was volcanic activity, and sheets of lava were poured into the lake.
5. The lake, generally fresh, was at certain times reduced and evaporated, so that beds containing salt, borax, silica, and lime were chemically precipitated and mingled with the detrital silts.
6. The volcanics change to olivine basalt.
7. Final flows of olivine basalt.

8. Probably before the deposition of the Tertiary, but not becoming important until during and after the close of this period, came a disturbance leading to rapid folding. The crust was bent, and perhaps broken, forming hills and valleys. Death Valley was created.

9. The mountains were eroded, producing minor irregular forms. The climate being slightly moister than now, a shallow lake a few hundred feet deep was formed in the bottom of Death Valley. This soon became charged with salt, borax, etc., derived chiefly from the leaching of the earlier lake beds, now become mountains.

10. The climate becoming drier, the lake evaporated, leaving a salt desert.

Colonel E. F. Browne, a writer quoted in the *Los Angeles Mining Review* in 1906, visioned ancient Death Valley as a huge crater, with water playing no special part except to provide operating material for geysers such as mankind has never beheld. This is his picture:

The disturbance centering in Death Valley is the greatest action of the kind on the continent..... The great lava flows [to the east and west of Death Valley] show that they ran out of this tremendous slag pot..... The northwestern arm of Death Valley is plainly the effect of a central force dividing the Grapevine and Panamint ranges, accompanied with such excessive surface heat as to destroy surface rock structures and cause remarkable disintegration. The flinty Cambrian structure, having been roasted and cooled, broke into fragments and has been sliding down into the valley for untold centuries, until now great slides of rock slope down toward the valley from either side. This slide extends all around Lost Valley and Death Valley proper..... There is no evidence that any body of water ever existed in this valley north of Boundary Canyon.

From Furnace Creek on down to the south end of the valley and around the great bend of the Amargosa River, evidences of the dying gasps of this great volcanic action are plenty, with here and there an evidence of water; but the only part that Death Valley took in the water questions was to let it run into great craters and spit it out again in geysers that would make the Yellowstone look like a firecracker alongside of a 12-inch gun.

Down the canyon toward Saratoga Springs, broken up beds of gravel are found which show conclusively that the lake or sea, when it existed, was east and south of Death Valley, and that this tearing force which created the Funeral and Grapevine ranges on the east

and the Telescope and Panamint ranges on the west carried the bottom of this inland sea clear up to the top of the Funeral range; and if any sea had been dried up at all, it was done in short order, with a display of force that shook the world, and a roar of steam and gas that would appall a continent.

Along the south side of Furnace Creek, for a distance of twenty-five miles in length, east and west, and from two to six miles in width, the results of geyser action have left the most awe-inspiring landscapes I have ever seen.

Great hills and mounds of soft fine clay and ashes, colored pink and green, brown, gray, yellow, and white, roll on and on with noses of black burnt-up rock intruding here and there, and creating a scene worth traveling 500 miles to see. The colors are so vivid that if painted on a canvas the artist would be deemed a crazy man.

These remnants of great dead springs have left mountains of mineralized clay to mark their resting place. The green indicates arsenic, the gray niter, the brown and yellow iron, the white borax and soda. It would all indicate that one time a rivalry existed between these varied chemical springs as to which could spout the highest and "cough up" the greatest mountain of chemical mixture.

Think of a borax mountain one thousand feet high and four miles around, and several others down to the size of the Egyptian pyramids. Think of a green-stained hill three times as big as the Capitol at Washington, with arsenic in it enough to poison the world, and you have only commenced to think of the immensity of these great chemical mounds.

The decomposition of mountains of tufa and the natural washing down into the valley left over the surface of Death Valley .... a reprecipitation of the decomposed colemanite [technically ulexiti] of the hills.

One need know very little of geology, and only a fraction of the findings of the geologists who spent months in that region, to appreciate Ball's statement that "the history of Death Valley has been complex." While a few paragraphs suffice to sum up the happenings of ages, it is easy to credit that when some of the sublime pyrotechnics were in progress there were quick changes, and plenty of them, in the topography of that region, while at least neighboring parts of the earth's surface underwent such convulsions as the human mind cannot conceive.

Since establishment of Death Valley National Monument, much study has been given to its geological as well as other features by Park Naturalist H. Donald Curry. We quote from a report by him:

It exceeds all the parks in the continental United States except Yellowstone in area; and its distinctive types of scenery, its geological phenomena, its flora, fauna and climate are not duplicated by any other area in the National Park system. In all ways it is unique and distinct.

A remarkable phenomenon of the Valley is the millions of tons of rock debris that has been sluiced through these narrow slots in the mountain sides. Steep, mile-high slopes and scarpments of rough weathering limestone, quartzite or schist are a challenge to the mountaineers. Dry waterfalls, tens and even hundreds of feet in height, bar the hikers' way in many of the canyons.

Death Valley is perhaps the most remarkable assemblage of geological phenomena of any area similar in size on the continent. Almost the whole of recorded geologic time is represented in the rocks that form the bounding ranges. It is not an easy history to read. It is believed that research now in progress may bring out some new and revolutionary concepts bearing directly on some of the fundamental problems in the science of geology. The barren mountains, unclothed by vegetation and with little or no surface debris, give up their secrets more completely than do more modest lands. Soon Death Valley National Monument will be more famed throughout the world as a marvelous complete museum of the ancient past than as a hot and barren wilderness.

Colonel Browne declared:

There is no good reason why mines of precious metal should be found in Death Valley. With the exception of a place in the north arm of Death Valley where an intrusion of later andesite exists, and the several places around the bed of the Amargosa where the granite noses appear, there is no good geological reason why any precious metal mines should be found "inside" of Death Valley.

But he pronounced Death Valley the best-prospected section of the world. "Nine-tenths of the men [who worked at the borax fields] had taken that employment for the purpose of seeking out the treasure." Accuracy suggests the statement that a large proportion of the men who toiled

Photo by Frasher

In Golden Canyon

Photo by Willard

Mushroom Rock

on the borax fields were Chinese, a people not much given to roaming the hills on prospecting trips.

Contrary to the views of Colonel Browne, a more recent writer declared:

> In the mountain fastnesses which wall either side of the valley are stored nature's treasure chests—gold, silver, and lead mines of such fabulous wealth as to stagger the imagination. . . . . There are canyons leading into the valley which have never been trod by the foot of man —the mysterious strongholds of nature's wealth of gold and silver.

That paragraph, worthy of the Arabian Nights, is even less commendable than Browne's pessimism on the subject, for it might help to send some credulous gold hunter to a sad disillusionment. Mankind is ever prone to hold that the more natural drawbacks there are in a region, or the more inaccessible it is, the less probability there is that it has been well prospected; hence thousands of men have tramped the desert mountains. Geological theories are sometimes ignored by those whose idea is that "gold is where you find it," and, while there are extensive regions where the most unscientific tyro would not prospect, probably every canyon has had many visitors. There have been some discoveries, of ore that had to be mined and worked just as it is elsewhere, but such "fabulous wealth as to stagger the imagination" is still missing.

"Lost mine" stories have had much to do with prospecting trips into the Death Valley country. The oldest is the Gunsight, a legacy of the Death Valley party of 1849. Several different versions of the story have been printed. One attributes the Gunsight find to J. W. Brier; there is no supporting evidence, in the Brier writings or elsewhere. On the contrary, J. W. Brier, the son, writing in *The Grizzly Bear* in 1922, said the find was made by the Towne party. In an article published in 1872, P. A. Chalfant, who started with the 'Forty-niners as a member of the "San Francisco party," reviewed the general experiences of the emigrants, and continued:

In scattered bands the main party finally reached the desert region neighboring upon the Valley of Death. In the midst of a desert stretch two or three of the party went to a range of hills a mile or two off the line of travel in search of water. They came back and reported that they had found no water, but a mountain of something they believed to be silver. But water was of more importance than either gold or silver, and those people plodded wearily on. A party of young men, among whom were Dr. McCormick, Willie Webster, and one or two others of our personal acquaintance, resolved to go back and see for themselves whether the story of that silver mountain was true..... In the fall of '50 the writer, while prospecting around Rough and Ready, Nevada County, paid a visit to his former townsman and fellow emigrant of '49, Dr. McCormick above mentioned. In due course he related the story of the trip and of the silver mountain to which we have stated he and others returned. He described the mountain as being in many places literally seamed with strings or wires of silver. But, in his opinion, it could never be made of much value as it was situated in the midst of a most horrible desert some three hundred miles in the wilderness [Los Angeles was the nearest settlement], the nearest water being 25 or 30 miles distant, and that of such a degree of badness that it was wholly unfit for use when packed so far. Besides this, the rock was so hard that the services of a blacksmith would be required constantly in repairing tools to work it, even if they could be made to work at all. He thought, however, that he would sometime organize a company and go out there and see what could be done, but this the doctor never did or attempted to do, so far as our knowledge goes. He said that in many places the rock fairly glistened with silver.

Though working under such adverse circumstances, the party obtained a number of pieces of the silver rock and carried them to the camp, where they pounded the rock out of the labyrinth of silver wire with which each piece was literally bound together. As a result of his own work, the doctor showed us a full handful of this silver wire, in various lengths, angles and curves, bright and shining as a silver dollar. Silver it was without doubt, and we have no doubt whatever of the truth of the doctor's statement in relation to the existence of such a mountain of silver—i.e., the "Gunsight lode." Certain it is that the wires he exhibited were any of them abundantly large enough for the forward sight of a rifle.

This evidence, third-hand to the reader, is the most direct available concerning the much-talked-of lode, of

which no later trace has ever been found. It lacks only the detail, sometimes supplied, of the actual use of a bit of the metal for a gunsight.

Another story of the Gunsight had it that the find was made by Townsend, of the emigrants of 'forty-nine. He took a piece of ore to a gunsmith and asked him to make a sight for his gun. The smith worked on it a little, and finally told him it was pure silver. Townsend said he found it while coming out of the Valley, but the location was never made plain. Several details of this account are at variance with those of other emigrant historians.

Breyfogle and his gold have caused even more discussion. In the recent past a long story purporting to be the history of this lost mine was given by a magazine writer, but its value was discounted at the start by the assertion that Breyfogle, reputed discoverer of that bonanza of the 'sixties, started out from Hawthorne, Nevada, and returned to that town on the shore of Walker Lake. The historical and indisputable fact is that Hawthorne was utterly non-existent until over fifteen years after the Breyfogle tale started.

Extracts from the record by R. H. Stretch, quoted in an earlier chapter, prove that Breyfogle was then (1866) in pursuit of his will-o'-the-wisp, and that he believed it to be in or close to the Funeral Mountains. An effort was made, when Goldfield was found, to identify the Jumbo, one of its big mines, as the Breyfogle bonanza. The more indisputable parts of that effort relate that Breyfogle was a blacksmith in Austin, Nevada. In the summer of 1864 he left with two saddle horses, and traveled and prospected for twenty days. He made camp at a spring; the next morning both his horses were gone. In trying to follow them he became bewildered. He broke some rock from a ledge and went on. He was seen by some Indians, who found him to be insane. They took him to camp and tied him up to keep him from jumping into the water, and kept

him under guard for a week. In his delirium he had thrown away his hat, and the top of his bald head had been sun-burned to a blister. This circumstance gave rise to a story that he had been scalped, when the fact was that the Indians had saved his life. When he was ready to travel, the Indians took him to the road between Silver Peak and Austin, gave him a horse which they had found, and he went back to Austin. He had retained his ore sample, and its richness started the hunt which presumably has never been rewarded.

One story was that he went to Los Angeles with a bag of coarse gold and nuggets which he said he had found in the pack of a dead man south of Frémont's Peak. The difficulty with this version is that from all records Breyfogle came and went from the Nevada camps entirely, as well as the certain fact that he was doing his renewed gold hunting far north of Frémont's Peak. Another story about "the crazy Dutchman from Reese River" was that his specimen was a nugget of California gold, given him by a party of prospectors he was trailing. Wishing to rid themselves of his occasional company, it was alleged, they gave him the specimen and told him it was found at a place they designated, away from their route.

Each of the neighboring ranges has had its "excitements," great or small. Lyons district, on Cottonwood Creek, existed in name at least; no other record of it has been found. Panamint, 1874–75, was the talk of the Coast for a little while, and in most of the years since then that camp, almost under the shoulder of Telescope Peak, has been the scene of some activity on the part of hopeful souls who held that "thar's gold in them thar hills." Not many miles to the north, Skidoo, from the near vicinity of which one can look into the depths of Death Valley, lived its brief day during the first decade of the century, had some production record and a lynching, and faded. Near the top of the Black Mountains and southeasterly from

Bad Water, Greenwater tempted the wasting of millions of dollars before its copper ores were found to have insufficient depth. Up near Chloride Cliff a prospector found claims of such promise that before he had done any worthwhile work on them he sold the property, the Keane Wonder, for $150,000.

The mountains bounding the lower valley promised a mining boom in 1914. Interest went far enough to launch a camp called Carbonate. Ashford Brothers were among the many who made locations in the Black Mountains and were well pleased when they unloaded their holdings on a Hungarian count for $60,000. The nobleman was equally delighted when he transferred ownership, receiving $105,000. McCausland Brothers, the final buyers, were the only ones concerned who did not share the general satisfaction. They went ahead with mining operations and built a 50-ton mill out in the middle of the south end of Death Valley. Abandoned, it still stands, a short distance from the road, a conspicuous monument to disappointment.

Leadfield and its skyrocket boom occupied a recent place in mining history. Perched close under the summit of the Grapevines, it had the desired element of difficulty of access. It had a strong speculative backing, and in fact most of the qualities of a successful mining camp except paying ore. Today there is probably not even a watchman on the site.

Industrial minerals have played a larger part than metals in Death Valley's history. That melting-pot of the ages has had a past so favorable to the production of natural chemical combinations that men have sought and found many different substances. Not all have been discovered in commercially profitable quantity or quality, however. The American Niter Company located large areas in the southeastern part of the Valley for niter, of which samples showing up to 61 per cent were found. At the other end of the Valley, one hundred and thirty miles

distant, locations for sulphur were made by a foreigner who referred to the place as his "matches mine"—probably a continuation of the same deposit which, over the summit of the Last Chance range and only a few miles away, has been recently worked.

An area in which the soil is impregnated with alum, and where according to a prospector there are hills of that substance, lies south of the main part of Death Valley. The same vicinity is also plentifully supplied with magnesium or Epsom salts. A company began operations there a few years ago, and the vast quantity of mineral in sight led to the construction of a monorail line as an early step in development. The material blanketed the surface in a layer from two feet to twelve feet in depth, and portions of it, we are informed by the superintendent of operations, were 100 per cent pure Epsom salts. But it could not be gathered in trainload quantities without including much foreign matter, and this proved a serious interference. Not all hope of success has been abandoned, however, and there is yet a possibility that the field will be profitably worked.

The monorail began with a single engine and car combined, the engine being of the common tractor order, changed for the purpose. Other equipment later consisted of cars in pairs, each car of five tons capacity, and the pairs being practically balanced on the sides of the central rail. They could make a safe speed of fifteen miles an hour on the level; double that speed could be made, but was hard on the track. Heat also caused trouble on the rail line. About fifteen sixty-ton loads were shipped before the enterprise was suspended.

The line extends from a point on the Trona Railroad to the mineral fields, a distance of almost thirty miles. It crosses Searles (borax) Lake, then winds through Layton Pass in the Slate range, across the south end of Panamint Valley, and through Wingate Pass. Those traveling the

latter route observe the now unused line a short distance from the auto route, and note that in construction it bears a rail on the apex of legs set in A shape. It was built in 1923, and used in 1924 and again in 1927. The storms and heat of the passing years have not greatly altered the fresh and unweathered appearance the road had when it was constructed.

Specimens of gem minerals and semi-precious stones occasionally find their way into the market from Death Valley and thereabouts, and many newspaper articles have told of individuals who have found such deposits. Opals, moonstones, bloodstones, moss agates, and possibly others have been displayed as having come from Death Valley —exact locality rarely stated. A party of which the writer was a member encountered a gem hunter one day. Near where the road enters the Valley from Boundary Canyon a bronzed prospector had established his showroom, using a large flat rock as a table on which to display attractive specimens of ore and of gems both rough and polished. The welcome given betokened more of a desire for human society than for customers; however, the owner soon became enthusiastic in his efforts to sell a half-interest in a claim to one of the party who incautiously made an encouraging remark. The prospector was a true son of the desert, and informed us that he knew the country for a thousand miles north and south and five hundred miles east and west better than any other living man. His discourse on gem mining was interesting, but his explanations of "metatiferous" ores and "pre-Camberian" geology failed to consummate a sale.

IX. BORAX

The great sink's fame as a producer rests on its borax output. It was the original home of the twenty-mule team, and for years the chief center of American borax gathering. How Aaron Winters, miserably existing in his desert home, learned of borax from a wandering prospector; how he cannily found out how to test for the mineral; how he went to the marshes and proved the presence of what he sought, may be quoted here from the present author's *The Story of Inyo:*

Sometime in those lonely years [before 1880] one Aaron Winters and his frail Spanish-American wife, Rosie, located at Ash Meadows, a place eastward across the Funerals from Death Valley, and 200 miles from the then nearest railroad station or settlement. A visitor to their home thus described it:

"Close against the hill, one side half hewn out of rock, stood a low stone building with tule thatched roof. The single room was about 15 feet square. In front was a canvas-covered addition about the same size. The earth served as a floor for both rooms. One side was the lady's boudoir. There was a window with a deep ledge, in the center of which was a starch box supporting a small looking-glass. On each side of the mirror hung old brushes, badly worn bits of ribbon, and some other fixings for the hair. Handy by was a lamp mat, covered with bottles of magnolia balm, complexion powders, and Florida water—all, alas, empty, but still cherished by the wife. In place of a library there were a number of copies of the *Police Gazette*. The sugar, tea, and coffee were kept under the bed. The water of the spring ran down the hill and formed a pool in front of the house, and here a number of ducks and chickens with a pig and a big dog formed a happy group, a group that wandered about in the house as well as romped beside the waters of the spring."

One night a strolling prospector tarried at the Winters home. He told about the Nevada borax deposits, and what a great fortune was ready for whoever could find more borax beds. Winters, careful not to indicate any special reason for seeking knowledge, asked many questions in a casual way. Among other things he learned that supposed borax could be tested by pouring certain chemicals over it and firing the mixture. If it burned green, borax was present.

When the guest left, Winters made haste to get chemicals from some remote supply point. He had seen stuff in Death Valley answering the general description of the Nevada borax. Equipped with testing supplies, Winters and his wife journeyed across the Funeral summit to Furnace Creek and made camp, then went to the marsh and got samples of the deposit. At night they mixed their powdered samples as they had been told, poured alcohol over it, and struck the match that was to tell the story.

How would it burn? For years they had lived as the Piutes of the desert. Mesquite beans and chuckwalla had served them for food when flour and bacon were missing. The wife had felt the utter loneliness of their situation and the absence of everything dear to the feminine heart. The color of the flame would tell them whether better things were ahead, or if the same dreary existence must continue.

Winters held the match to the mixture with a trembling hand. After an instant's pause he shouted at the top of his voice: "She burns green, Rosie! We're rich!"

But Winters was not the first to believe that borax was to be found in the Valley. Many locations for it were made in desert places in 1873. In referring to them, the *Inyo Independent* of May 10 of that year said:

Extensive deposits [of borax] have recently been found and located at two or three different points in Death Valley. .... One of these deposits is in the immediate vicinity of the spot where those '49 emigrants abandoned their wagons, which were subsequently burned by the Indians.

Parenthetically, this is the only allegation found that the Indians burned the wagons. No one who told of having seen the emigrant camp has mentioned wagon woodwork, though speaking of tires and irons, and the burning probably occurred.

But Winters started the real interest, nothing having come of the earlier locations. He sold his claims to Wm. T. Coleman & Co., wholesale merchants, for $20,000—more money than he had ever dreamed of owning, yet just that much more than the borax field was worth to him except for selling. Coleman started the Harmony Borax Works.

Another location preceded the Harmony in actual development. That was the Eagle works, on the ground mentioned in the newspaper quotation, a few miles northerly from Bennett Wells and twenty miles or so southwest of Furnace Creek. Its story is connected with that of Isidore Daunet.

Daunet was one of the many who drifted into the camp of Panamint, only a few miles from Death Valley. Matters did not go well with him there, and with six other disappointed treasure-seekers he set out for Arizona. The men, young and vigorous, selected a direct route, crossing the south end of Death Valley. It was midsummer, and they unwisely used their water supply too prodigally. They found no springs before they had resorted to killing their animals and drinking the blood to assuage their thirst. Then Daunet and another struck out for help. They were fortunate enough to find Indians who went back with them to rescue the five left in camp. Two of the latter were barely alive; the other three had perished.

This experience ended the journey not only for the dead men but for Daunet as well. He returned to either Panamint or Darwin. Hearing of the Winters discovery, he recalled the white marshes he had seen, and persuaded three men, J. M. McDonald, C. C. Blanch, and Myron Harmon, to join him in investigating. Satisfying themselves that the deposit was borax, they located two hundred and sixty or two hundred and seventy acres, and without delay began preparing for work. We are told that water was obtained by digging; it would appear that they opened a spring which thereafter flowed, for today their abandoned site is an oasis of tule sloughs and marshy meadow.

An iron pan 5 feet by 22 feet and 3 feet deep, and twelve 1,000-gallon vats were dragged across the deserts where there were no roads. When the plant was up, fifty men gathered "cottonball" from the marsh. The delights of that employment, under a blazing sun, may be imagined;

and so may the business of keeping the boiler hot by firing with mesquite wood. The company discovered that even though men might be heat-proof, Nature took a hand in preventing midsummer work; the solutions would not crystallize unless the air had cooled below the usual August temperature. However, a shipment of thirty-seven tons was finally sent out, but it was so impure that much of it had to be sold for eight cents a pound—not a profitable figure under the circumstances. The product was improved and a somewhat better price was obtained, but the whole venture was so experimental and costs were so high that when a total output of one hundred and thirty tons had been reached the plant closed down permanently.

The Eagle plant soon dropped into oblivion. It was sold for no great sum. One of the owners, Harmon, who had been a prominent merchant of Darwin, found his next occupation in running a restaurant in a small mining town. This writer met him years later, when he had become an official of the New Almaden, California, quicksilver mines. Only the seeping spring and the spread of meadow land in parched surroundings are now left as permanent benefits of the Eagle undertaking.

Coleman put up his Harmony works a short distance northwest of Furnace Creek, on the edge of the marsh. A few frame buildings housed the workmen, and the plant was partly out of doors, partly within an adobe structure. Ulexite, or borate of lime, or "cottonball," or blanket cotton, is soft and requires no crushing. While its content of boracic acid is slightly lower than that of some other borates, the absence of the necessity for crushing is advantageous. It was gathered in chunks and balls from pinhead size to balls ten or twelve inches in diameter, loaded into wagons, and hauled to the tank. It was dumped in with water and carbonate of soda material that had been hauled from another desert point. As the mass was heated by the boiler and stirred, new chemical combinations were

formed. The carbonic acid in the carbonate of soda took up with the lime, forming a compound that precipitated, while the soda combined with boracic acid and remained in solution as biborate of soda. This solution was drawn off into vats in which many wires or rods were suspended. The borax crystallized on the rods, and in due course was knocked off and piled up to dry for shipment.

The Coleman concern was one with varied interests and was forced to make an assignment in 1889. Its activity in Death Valley had lasted four or five years. Its property there was taken over by the Pacific Coast Borax Company, which had been operating in Nevada. No more work was done at the Harmony plant.

All the mountains in the Furnace Creek neighborhood, and for miles from it in some directions, appear to contain borax. Colemanite outcroppings are found for a distance of twenty-five miles, prospect pits showing a bed four to six feet in thickness. Monte Blanco rises southeast of Furnace Creek, a thousand-foot peak crusted and inlaid with borax. Cub Lee, who frequently appears in Death Valley annals, is credited with discovering colemanite in that vicinity. The Pacific Coast Company began mining it and has put in miles of tunnels and drifts without beginning to exhaust the supply. Discovery of other and cheaper deposits has diverted attention to other fields; but if need should arise, there is still in the hills of Death Valley a vast quantity of borax that can be obtained.

Transportation was one of the immediate problems. The first hauling was done by Charles Bennett, under a contract. At the end of a year, Superintendent J. S. W. Perry was instructed to organize a system, and the result was the famed twenty-mule teams. The first step was to make a road across the salt marsh. Pinnacles were beaten down and hollows filled, and a solid crossing was made to the west side of Death Valley. This route followed closely that which the emigrants had taken. The distance to

Photo by Frasher

A twenty-mule-team wagon

Photo by Frasher

Entrance to borax mine

Mojave, where some of the delivery was made to the railroad, was one hundred and sixty-five miles; and there were but three springs of water along the way. As teams could go but sixteen or eighteen miles a day, provision had to be made for many "dry camps." Ten stations were established. Tank wagons, each carrying 1,200 gallons, were built, to be hauled from springs to dry camps, and back again when empty.

Perry got all the data he could about big wagons, then had ten built by day's work in Mojave, on his own specifications. From many sources these dimensions of each wagon are learned: bed, 16 feet long, 4 feet wide, 6 feet deep; hind wheels, each 7 feet in diameter, tires of steel 8 inches wide, 1 inch thick; hubs, 18 inches in diameter, 22 inches long; felloes, double, each section 4 by 4, bolted together; spokes, oak, 5½ inches wide at butt, 4 inches at point; axles, steel, forward 3¼ inches in diameter, rear 3½ inches; wheel tread, 6 feet; weight per wagon, 7,800 pounds; cost, $900 to $1,000. The wagons were hauled in couples, and carried loads up to 46,000 pounds of borax. Add to this weight the nearly 16,000 pounds of wagon and the hay and water that had to be taken on every trip, and it will be seen that the teams of eighteen mules and two horses had to be well-chosen animals.

Each wagon was equipped with a straight-grained oak tongue, costing fifty dollars in the rough, 8 inches thick at the rear end, 5 inches at the front. From it stretched a chain with links of half-inch steel, to the end of the "string," 120 feet ahead of the driver. Brake rods on the wagons were bars of steel 3 inches wide and ¾ inch thick.

The driver wielded, with both hands, a whip with a 6-foot handle and a 22-foot lash; probably a blacksnake also. Besides, he was always stocked up with pebbles, which were used as accurately as might be for reaching some unwilling animal beyond the whip's reach. Keeping the "box of rocks" full was one of the "swamper's" duties.

Those of that era who considered themselves good "whips" because of ability to steer a coach and six might have found themselves in difficulties if they had undertaken to control one of the "big teams." A quarter-inch round rope, leading to the head of a lead animal, was the directing telegraph; a pull on the rope meant a right turn, a jerk or a slapping of the neck said turn to the left.

While drivers and swampers were men of slight attainments in some directions, they had to be men of resourcefulness and capacity in their line. What to do for a sick horse, how to shoe a mule of high kicking ability, without blacksmith shop accessories, were items of the job. They had to stand long sieges of heat and exposure to burning suns and chill winds. Above all, they must know how to get their teams around the twists and turns of the road, up and down hills, and over dangerous grades. Their animals were carefully chosen for intelligence, and some of the spans might cost as high as $1,000. There were places where some of the animals would have to step over the chains and pull at right angles to the rest of the team in order to keep the wagons in the road.

Teaming as well as borax making was suspended during the hottest weather, but teams ran as late as July 1 during the Coleman régime. The superintendent stated that the work had never caused the loss of an animal. It was also said that in five years' time there was never a wagon breakdown.

F. M. Smith, long the directing genius of the borax company, sought to supersede the twenty-mule teams by using tractors, early in the present century. The engines were specially made; and while it may be assumed that tanks and other aids were part of the outfits, the experiment proved a failure. It was estimated to have cost Smith $100,000 when, late in 1904, its abandonment was announced.

Another stage of development came with the building

of the Tonopah & Tidewater Railroad and the addition of the Death Valley Railroad from Death Valley Junction to the present Ryan. *The Technical World* in 1915, the first year of its use, pronounced it "the most remarkable railroad in the world." It is about sixteen miles long, narrow gauge. Its cost was $300,000, about a third above estimates. The maximum grade is 1½ per cent. The hauling capacity is 250 tons daily. Construction was done in ten months, with the help of 400 men and 200 mules. The picturesque twenty-mule team faded from the picture, and borax shipments from the region have since gone out by rail.

The visitor who, in the better days of the D.V.R.R., wished to see all he could by rail travel changed to the narrow-gauge at the Junction. At Ryan another change awaited him, for he could get into the cars of an 18-inch electric "baby railroad" and on it ride for three miles or more through the underground workings of the mines.

There is romance and interest in the full story of nearly every substance that enters into our daily affairs; few others equal borax in that respect. Persons now living can confirm that the substance once sold in drug stores at twenty-five cents an ounce, instead of being marketed as it now is at a few cents a pound. Its decline in price through the discovery of great quantities of it in the West and the changes in methods of production are details that might not interest the casual reader; others who wish to pursue the subject will find probably the best obtainable treatise in the report of State Mineralogist Henry G. Hanks, published 1883.

Borax has come to be a highly important factor in every-day affairs. It is a water-softener, cleanser, grease-solvent, deodorant, preservative, shampoo; it is mixed in starches, and forms the basis of many cleaning compounds. It is used in making enameled ware, glass, pottery, paints, metal fluxing, leather manufacture, heat-resistant compounds, and other products to a total of more than fifty.

X. NATURE'S NOVELTIES

More than half of the below-sea-level area of Death Valley is covered by a saline or alkaline marsh. In some sections borates predominate, in others the surface is common every-day salt. The whole makes a bed forty miles long by two to five miles wide, flooring much of the Valley from Salt Creek south.

It is not a mere surface coating. Mr. F. W. Corkill, for some years superintendent for the Pacific Coast Borax Company in that district, had three wells drilled in 1915, one five miles north of Furnace Creek Ranch, one nearer to it, and one fifteen miles south. The respective depths were 1,000, 1,005, and 1,009 feet. Each passed through a few feet of surface mineral, then encountered a shallow clay stratum. Below that were 150 feet of salt, then a thin sheet of clay, then another deep mass of salt. This alternation continued to the bottom of the boring, at which point work ended with the drill in solid rock salt. No one knows what the total depth may be, but probably nowhere else in the world is there such a mass of salt.

Some parts of the surface are marshy, in the usual sense. One estimate has been made that a third of the surface is virtual swamp. In such neighborhoods there are numerous small channels of stagnant or slowly flowing water. In some of the areas men have broken through the surface crust and found a miry ooze beneath, into which a pole could be pushed to its full length without difficulty.

The white plain looks at its northern end as any alkaline surface would be expected to look. Toward the south it gradually assumes the appearance to which the name "Devil's Golf Course" has been given. Where the marsh merges into the sand at the edges, and where the salt hummocks may be the oldest, they are low and much browned by the soil which has been blown upon them. The appearance is much like a muddy pasture which has been churned

by innumerable hoofs. More to the south, the hummocks increase in height, disorder, and average whiteness, until the suggestion is of sea instantly frozen while being tossed by contrary and violent winds. The surface is rock salt, in pinnacles and spires and knife edges, so hard that even a thin shell will support considerable weight. It gives a metallic sort of clink when broken. There is not, in miles of distance, a spot where a man can stand flatfooted among the tumbled masses. Soil, brought by the winds, has lodged in low spots, but changes come so often there that the drifted earth makes no leveled surfaces. When it is moist, it is mud of glue-like tenacity.

A technical report says the hummocks are from six to eighteen inches high. Those measurements are short of the facts. There are some pinnacles at least three and one-half feet high, and there are thousands two feet or more from base to tip.

Seen from above, as from Dante's View, the field is marked by channels which are not noticeable from the edges.

The material has not the intense saline taste one would expect. Analysis by M. R. Campbell, of the Geological Survey, gave the following percentages of components:

	Per Cent
Chloride of sodium (common salt)	94.54
Chloride of potassium	.31
Sulphate of sodium (Glauber's salts)	3.53
Sulphate of sodium, hydrous (gypsum)	.79
Moisture	.14
Undissolved residue (gypsum and clay)	.50
Unaccounted for	.19

New pinnacles, solid-looking as marble, are forming at the edges of the field. Each is completely surrounded by a crack of knife-blade width. A chemist friend explains this peculiar marking off on the basis of the constant though very slight motion of the salt field. The chief evidence of

such motion is at the edges of the cracks, where lack of exact conformity in shape of opposite edges can be discerned. The salt's property of absorbing moisture from the air has little encouragement most of the time, but occasionally there is moisture to absorb. A saturated solution gradually reaches the cracks. Recrystallization takes place, which causes expansion, and the block is gradually forced to greater height. More soil and more salt is washed down, continuing the process of elevation, while the base gradually lessens in size.

The blunt nozzles of many small air vents are visible, their presence accounted for by subterranean inflow of water from higher ground until its weight forces through weak surface spots the air it has carried with it.

"Salt pools," said to number fifteen in all, are found. Each is an irregular-shaped hole a few feet in diameter, like the mouth of a rough shaft or well, margined with a white salt of high percentage of purity. The placid water, perhaps a foot below the rim, is crystal clear, but flaked in spots with snow-like crystals. These tiny objects change constantly and gradually join the countless others that make up the salt rim. Beautiful specimens of crystals in all sizes are at the edge of and beneath the overhanging edge. The pool examined inclined toward the west as it went down. An improvised plumb line struck its side at about sixteen feet. It was believed that with suitable apparatus a sounding of forty feet or more could have been made.

Mushroom Rock, the most singular object for its size in the region, stands close beside the road between Furnace Creek and the Devil's Golf Course. Perhaps eight feet high—if we took measurements they have been lost—it is well described by Spears: "A form best pictured by putting a bunch of cauliflower on a mirror." Possibly the lava composing it cooled in unusual form; undoubtedly wind-driven sand has had a part in carving its present shape.

Not the least of things to see are the striking canyons. Golden Canyon, two miles south of Furnace Creek, is the most accessible, being reached by a short trip over a fairly good road. The entrance is through a mighty gateway to an amphitheater surrounded by weather-worn sentinel pinnacles.

Corkscrew Canyon and Gower Gulch penetrate the tumbled mountains in successions of twists.

Furnace Creek, Boundary, and Grapevine canyons and Goler Wash are natural rifts through the mountains, as if nature designed them for the easy roadways that have been made through them.

Titus Canyon, forty-six miles from Furnace Creek, is reached by travel over a soul-trying road, but is worth the effort. Its sheer walls, twenty to sixty or seventy feet apart, rise almost perpendicularly for several hundred feet. The structure of the canyon is no more striking than its coloring. From base to summit the walls are banded with broad stripes of pastel shades, subdued and beautiful. Its total length, from the great cup in which the abandoned camp of Leadfield is situated, to the Valley edge, is a mighty, twisting gash, as if the mountain had been torn asunder for eight crooked miles.

The Panamints have their own odd canyons. Mosaic is thus named because of the varicolored stones which, set in a lasting matrix, have been given a degree of polish as ages have passed. Grotto Canyon, in that range, speaks for itself in the picture shown facing page 132.

Ubehebe Crater—so called though miles distant from the Ubehebe Mountains—is the big natural show item of the Valley north of Mesquite Flat. The location is northwest of the mouth of Grapevine Canyon, and it is reached by about two miles of travel over a well-defined side road from the old main road through the Valley. Recentness of volcanic action is apparent along the route, the sand being strewn with cinders and bits of lava.

The crater is set in the top of one of many low hills. An automobile is easily driven to its very rim. Below that rim a funnel a mile in diameter runs downward for 780 feet, ending in a level floor of sand clay 800 feet across. The measurements are credited to a 1926 investigation by Lieutenant Noble, of the Geological Survey. This rim measurement has been disputed, probably correctly; no survey has been made to determine the point exactly. Faith in topographic sheets is somewhat shaken when no indication of the crater is found on them; doubtless another and more nearly correct issue of that topographic sheet, the Lida, will be forthcoming sooner or later. Other and smaller craters are also to be found in that section of the Valley.

Death Valley's sand dunes are not distinctive possessions, for such structures are found elsewhere on the great desert and in other countries of the world. Nevertheless that spread of wind-formed hills, piled up on a floor below sea-level, and with probably none of their summits reaching sea-level, is an attention-arresting sight. The dunes cover an area four to seven miles wide and about twelve miles long—that is, those were the measurements two or three years ago. They have had time to change since.

In places new dunes have begun to form, where sand has begun to pile around the bases of struggling mesquites. Any such spot may be the nucleus of what may grow to rival the ridges and peaks that have in similar ways claimed some of the Valley for their own. Many of the sloping sand surfaces are rippled by the winds as they would be by the gentle washing of waves.

One of the more recent discoveries is a natural bridge spanning a canyon in the Black Mountains about fifteen miles south of Furnace Creek. Its arch is about fifty feet wide and fifty-five feet high. After it had been reported, old-timers claimed to have known of it before. They had modestly kept their knowledge secret.

Much is to be seen in Death Valley from its floor, but

Photo by Frasher

Grotto Canyon

no trip there is even half complete without a view from the heights. There are scores of grand observation points; nearly any summit will answer. Dante's View, well named, is the most accessible and most popular. Chloride Cliff, overlooking the northern arm of the Valley, gives a fine sweep of vision across the dunes to the distant Sierra and the salt fields in the southern view. But that outlook, from an elevation of 5,400 feet, lacks the abruptness of the scene from Dante's View. This View, twenty-four miles from Furnace Creek and twelve miles from Ryan, is about 6,000 feet high, and its cliffs sweep down to sea-level hardly a mile northwesterly. It is reached by a steep, winding, and "rough but passable" road from the route between Shoshone and Ryan. A windowed kiosk sits on the summit, and one can see the panorama in comfort if he desires.

Samples of all the varieties of weather the region affords may be encountered on the trip. The valley may lie in complete calm, while on the top a chill wind may blow, with the sky, though cloudless, so filled with haze as to mask the distance. On one trip, after a night of rainfall on the desert eastward, we found a snowstorm in progress, piling up whiteness so rapidly that some of the party feared trouble in driving down. There was no reason to linger, for nothing could be seen. Another visit gave a view wondrously, sublimely beautiful. There was no Death Valley. Instead, we halted on a rocky islet overlooking an ocean of clouds with its waves breaking against the steeps below. A mass of gray and silvery white tumbled and rolled and billowed to and over the western mountains and to the limit of vision northward. Changes came each moment. Occasional rifts opened, so that suggestions of what was below could be dimly perceived. After time enough for us to marvel at the prologue of the spectacle, the fingers of the wind began to tear the fleecy curtain apart. It divided into banners, streamers, tatters, shreds, which one by one were borne off and flung into the masses which continued

to mantle Telescope's crown. Sections of the abyss, here and there, became distinctly revealed through chasms and canyons in the clouds, realization of the depth being emphasized by the mile-high canopy whose changing shadows marched swiftly across the gray and brown surface below. The last cloud sought its fellow vapors in the west, and the great Valley spread before us in unobstructed view. It was a memorable sight, possibly such as we might never again be fortunate enough to experience.

From that height, on a clear day, Telescope Peak's rise to the summit two miles above the sea is impressively seen. Far northwesterly the White Mountains define the horizon, and more to the west the crests of the snow-crowned Sierra. We believed we were looking at Mount Whitney, but even with powerful binoculars we could not be certain. The claim of being able to see the highest point in the United States from the lowest, or vice versa, has no merit. From Mount Whitney's top one can see the rims above Death Valley; from heights above the Valley the tips of the Sierra can be discerned, all provided the day be free from clouds or, equally important, from haze. Try looking at the bottom of a posthole across the street and you have a small-scale duplication of seeing into Death Valley from the Sierra. The writer's knowledge comes from trying it both ways.

A road has been made to a point on the Valley's western rim, giving a magnificent sweep of vision. To it has been given the commonplace name of Grand View. There is a tendency to refer to it as Aguerberry Point, for a miner who has been in that vicinity for decades.

XI. PERILS OF THE DESERT

Dan de Quille, Virginia City writer of sixty years ago, told of a certain inventive genius who reasoned that as evaporation was known to be a means of cooling, a man equipped to provide it could safely travel in Death Valley on even the hottest days. The evaporator was built, and its owner set out. He failed to return when expected. A search party which followed his trail found that the apparatus had worked only too well, for he was found frozen to death.

De Quille wrote also of a party of prospectors who saw at a distance a strange spot of red. When they investigated more closely they were astonished to find the body of a woman, in a red calico dress. The preservative qualities of the salt and borax marsh on which she had died were such that every feature was natural as in life, even the facial expression being perfect.

But the long enumerations of Death Valley incidents contain little in the way of intentional fiction. Suffering, death, and insanity give no encouragement to romancing, and de Quille has had few rivals in his efforts. There are stories enough, too many, dealing with misery and death. Efforts at humor are discordant with the ever-present tragic undertone.

In the desert, as elsewhere, close companionship day after day, under disagreeable conditions, does not always make for continuance of peaceful relations. That was emphasized in the cases of the crews of the borax teamsters. Each crew consisted of two men, a driver and a "swamper" or man whose business it was to look after the more menial tasks. Men of education and of knowledge of the finer things of life were seldom among such employees. They found little to engage thought in the region in which they worked. Moroseness and suspicion grew naturally between associates on the lonely roads. Disagreements were so fre-

quent that it became the custom of the superintendent, at the end of each trip, to ascertain if the driver was satisfied with his swamper, and vice versa. If there was any sign of trouble, men were changed at once, to prevent a possible tragedy in the course of another forty-day round trip over the desert.

One of the teams drove into Daggett, then the headquarters of the borax company, with its men badly at outs. The swamper filled up with liquor and while in that condition was advised by another teamster to kill his driver. He did it, with a huge wagon spoke. Two nights later a mob took the slayer and his adviser from the town lock-up to where ropes had been thrown over the cross arms of a telegraph pole. The ropes were tightened, and stayed tight so far as the swamper was concerned. His adviser was lowered while still living, and lost no time in acting on advice that he leave.

The lonely grave of W. M. Shadler, a teamster who died on the road, is located in Wingate Pass.

Bill Ferguson, driver of one of the teams, had a swamper named Meiser. One night Meiser's mind gave way and he fled into the hills, believing that Indians were after him. Ferguson overtook him, knocked him unconscious, carried him back to the wagon, roped him securely, and took a night's sleep. In the morning he made Meiser as comfortable as he could and drove on to Bennett Wells. Men who were there refused to undertake the care of the crazy man, so Ferguson loaded him into the wagon and during a twenty-day trip to Daggett did two men's work with his team and landed the unfortunate safely.

Jimmy Dayton's grave, standing in the morning shade of a mesquite clump north of Bennett Wells, is one of the pictured spots of the valley. This is the true story of Dayton, as vouched for by W. W. Cahill, veteran official of the borax company and superintendent of its railroads:

James W. Dayton, aged sixty-two, died near Bennett

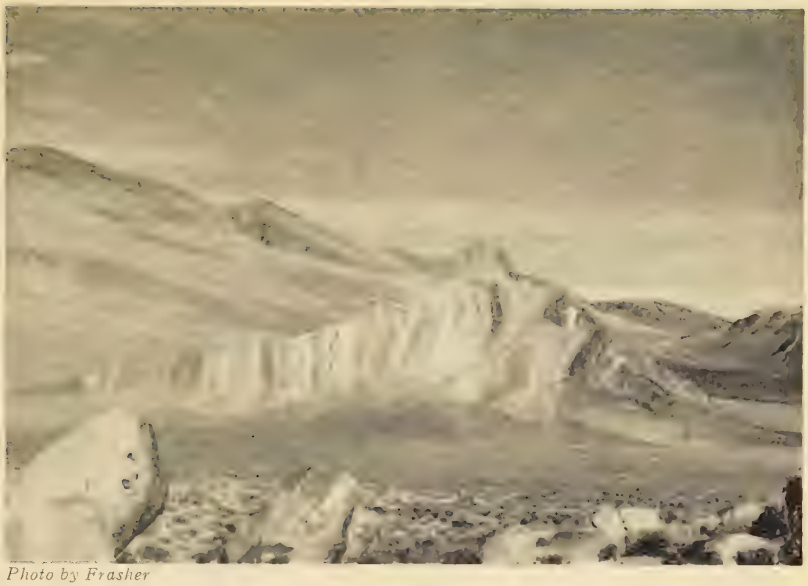

Photo by Frasher

Striped Butte

"BURY ME BESIDE JIM DAYTON IN THE
VALLEY WE LOVED. ABOVE ME WRITE:
HERE LIES SHORTY HARRIS, A SINGLE
BLANKET JACKASS PROSPECTOR."- EPITAPH
REQUESTED BY SHORTY (FRANK) HARRIS
BELOVED COLD HUSTER. 1856-1904.
HERE JAS. DAYTON, PIONEER PERISHED, 1898.
THE DANGERS OF THE LAKE, THIS BIT OF EARTH
IS DEDICATED, FOREVER.

Photo by Frasher

Tombs of Jimmy Dayton and Shorty Harris

Wells, August 1, 1899. Then, as for some years preceding, he was caretaker at the Furnace Creek Ranch, then called Greenland. As that was the hot season, therefore a period of idleness at the borax plant, he was the only white resident of the Valley.

He made periodical trips to Daggett, one hundred and sixty miles away, for supplies. On each trip he set the date of his return, invariably appearing at about the time set. When he failed to appear on August 6, his set date, the superintendent sent two seasoned desert men, Frank Tilton and Dolph Navares, to learn the reason for the delay. After passing Bennett Wells they found Dayton's wagon, with the carcasses of his four dead horses fastened to the wheels by their tie ropes. Dayton's body was lying under a mesquite tree. His faithful dog guarded it; the animal, being free to hunt water, had survived, though weak from lack of food and gashed by the teeth of coyotes which he had fought away from his master's body.

Jimmy had been taken ill, had unhitched and tied his horses, and had lain down never to rise again. The live stock, though fastened to a wagon in which were both feed and water, died from lack of both. This had happened, the searchers estimated, two weeks before their arrival.

Dayton was buried almost where he lay. Navares, relating the circumstances, said the only funeral service was an utterance by Tilton: "Well, Jimmy, you lived in the heat and you died in the heat, and now you've gone to hell."

A crude wooden headboard was set up to mark the grave, and the bones of his horses were strewn over the mound. That board was replaced by another, said to have been made from a discarded ironing board. There had been talk of a more substantial monument before Shorty Harris, dean of all desert rats, succumbed at a ripe age to ills of the flesh. Shorty requested that he be laid beside Jimmy Dayton. It was done, in the presence of a reverent company, and with the services of the CCC chaplain. Then the plan

for the monument was put into effect. Sponsored by the Pacific Coast Borax Company and Supervisor Charles Brown, it was constructed by CCC workers. Its unveiling, with suitable ceremonies, occurred March 14, 1936. Built of native stones set in cement, its face bears a bronze tablet inscribed:

> Bury me beside Jim Dayton in the valley we loved. Above me write: "Here lies Shorty Harris, a single-blanket jackass prospector." Epitaph requested by Frank (Shorty) Harris, beloved gold hunter, 1856–1934. Here lies Jas. Dayton, pioneer, perished 1898. To these trailmakers whose courage matched the dangers of the land this bit of earth is dedicated forever.

Shorty, knowing of the proposed monument, was concerned in having it visible from the highway. He was contented with the assurance that every passer-by could see it. Let us hope that the morbid-minded souvenir hunters who in the meantime carried away most of the bones of Jimmy's horses will keep their despoiling hands from the tombs of those men to whom the comforts of civilization were valueless.

Lee, a halfbreed son of one of the Lees of the desert, planned to start a saloon somewhere out on the road from Daggett. He started for his intended location as a passenger on a borax wagon with driver Smith and swamper Herb McChristian, the latter a boy of sixteen. Lee developed a vicious streak in camp, and threatened to kill Smith. The latter abandoned the outfit and walked back to Daggett. After his departure Lee promised to kill McChristian when they had finished supper. On the pretense of having something to fix on the wagon the boy secured a rifle and drilled Lee between the eyes. Lee senior, on hearing of the occurrence, went to Daggett with the avowed intention of wiping out the whole McChristian family. He was talked out of his bloodthirsty intention, the most potent argument being the calm information that if he mo-

lested the boy or anybody else he would be, in the crude diction of the place, "strung up."

Lonely and lawless roads gave robbers opportunity, but their intended victims were sometimes hard to loot. One such non-pacifist was Fred Hinkle, one of the best of the drivers. Several robberies had occurred and Hinkle had occasion to make a special trip in a buckboard. He put two pistols loaded with blank cartridges into his holsters, fastening one to the vehicle seat and one to the dashboard. Then he strapped two double-action guns on his body and donned a jacket. Robbers stopped him at a place called Indian Point, and supposedly disarmed him by taking the weapons from the seat and dashboard. He played badly frightened, and the thieves, thinking him harmless, turned to hunt for the $5,000 payroll he was carrying. Hinkle shot and killed both.

Such tragedies, in which men warped either naturally or by soul-trying circumstances played a part, did not differ in nature and motives from like occurrences in many other sections. It was in the toll that nature took from the careless, and events in which sinister human intentions had no part, that Death Valley maintained its distinction.

It is impossible even to guess intelligently how many lives have been given up to the perils of the desert found in concentrated form in Death Valley. One statement has been seen in print that the dead in one season numbered twenty-four, and it was estimated in Rhyolite (nearest starting-point for many trips into the Valley) that thirty had been claimed that year, 1905.

Prospecting, the chief reason for men going into that country before the later era of sight-seeing, received fresh stimulus with each mining discovery around the borders of the Valley. Panamint, over the summit of the western range, kept up the fever that the Breyfogle and Gunsight stories had started. Skidoo, from near which one may look down on the salt desert far below; Keane Wonder and

Chloride Cliff, of less fame; Greenwater, on the summit but a few miles from Bad Water; these and lesser mining finds in the region all accounted for many lives. Men would set out from one or another to prospect, or men having some camp as a destination would take a short cut across Death Valley to reach their objective. If a lone traveler had no relatives or friends to inquire into his fate he might take his place in the ranks of the unidentified dead. In Greenwater's livest summer, it was estimated that somewhere between two thousand and three thousand men were in the barren hills, and some were lost. Rhyolite was a further contributor to the fatal list, since many went from there to try their luck on the Death Valley side. They "took a chance," and numbers of them took no more chances anywhere.

One of the most striking localities on the Valley's border is Titus Canyon. It was named for Morris Titus, a young mining engineer who perished there. With two others, Mullan and Weller, he left Rhyolite to cross Death Valley and prospect in the Panamints. With a train of nineteen burros and two horses they traveled, the first day, to a place called Wood Camp, twenty miles. The springs they expected to find were dry. They went back to Mud Spring, and were told of a water hole they could find in Death Valley. The next morning they had, on breaking camp, only twenty gallons of water for themselves and twenty-one head of stock. They went down into Titus Canyon, but could not get out. In the afternoon they found a place where a cupful of water could be caught every four hours. While Mullan and Weller waited, Titus went on to look for water. He never came back. The next morning Weller took the stock and went on to find Titus and water. He too disappeared; seven of the burros he drove showed up at a spring three or four weeks later. Mullan, left in camp, stayed through a day and a night before he too struck out. He finally got back to camp more dead than

alive, and a fortnight later was found, still living, and brought into Rhyolite.

One man of more than average strength saved his partner and five burros from almost certain death in the Valley, but before long he almost succumbed to the same fate.

One stalwart young man was heard to lecture for an hour on the dangers of the Valley and what precautions to take. Within a week he himself was saved by a rescue party.

David Eldredge and a companion left the Panamints to cross the lower end of the Valley. When part way on their journey they realized that their water supply was too scant to enable them to reach the intended camp; they tossed a coin, the winner to take the burro and water and go on. Eldredge lost; the other reached the camp and got help, but on returning was unable to find Eldredge. It was surmised that he might have broken through a salt crust into the mire beneath.

Peter Busch and the driver of his auto left their machine, after a breakdown, to reach the east side of the Valley. The younger man hurried on to a spring and brought fresh water back with him, but found Busch dead, with a canteen of water beside him.

One man, believing that he was likely to perish, cut his palate with a knife so that the dripping blood would keep his tongue from swelling. He made it to camp.

A resident of the Valley once came upon the bones of a desert victim, and near by was about $400 in gold and some paper money. He gathered up the gold, but some superstitious notion kept him from taking the currency, which was left to go wherever the winds would carry it.

There is story after story of men who went into the Valley and were never seen again. As a rule there is no way of knowing what the conditions were as the victim came to his end. If there are means of identifying the body its discovery is reported sooner or later, but there were

many years in which civilization was remote and bodies were found and not reported.

Old desert men say that to try to cross Death Valley in summer is foolhardy. The universal verdict is that it is no place for a tenderfoot in hot weather, and some who know it well say they would not make the summer crossing for any amount of money. They claim that during those months one cannot see a hundred yards on account of the white soil and the haze caused by the intense heat. Ample water is highly important, but not the only factor. The heat claims its victims. Corpses have been found with water in canteens beside them or even in their hands. Even though the sufferer may retain his faculties, the water he carries may be so hot as to be useless for quenching thirst.

The victims are usually buried where they are found, and it is infrequent that so much as a weathered board shows where they lie. Such markers, when found, may serve the "desert rats" for direction purposes; for instance, a traveler relates that he met a man and inquired about the road. The man replied: "The road is plain for ten miles; then you come to a salt well. Six miles farther you'll come to Tim Ryan, Aug. 9, 1905, and two and a half miles southeast of him you'll find plenty of good water."

Sometimes those who are rescued have become insane. A common hallucination, it is said, is that they are breasting deep waters. They discard their clothing, and they have been found holding some of it high above their heads to keep it dry while the sun was searing their skins. One young man was found straining sand through his fingers; he said he was getting the pollywogs out of the water so he could use it. The wave-threatened insane may put their arms about the necks of their rescuers as a drowning person would. One naked man was rescued as he was trying to dig through the mountain with his fingers to reach Greenwater.

Frederick Monsen, traveler and lecturer, told a *Sacramento Record-Union* reporter in 1899 some of his experiences in a Death Valley trip. It took him three days to make the trip to the Valley from Daggett, one hundred and sixty-four miles, with a buckboard and a bronco team. He told that when they got within striking distance of the Valley his driver gave out and died in his arms. He changed his course to the little settlement of Pahrump, Nevada, and had to walk the last thirty miles because his team had given out and died on the road. He got two horses at Pahrump and went back to where he had left his buckboard and outfit, and went on into Death Valley.

Monsen found Cub Lee as watchman at the borax works. The plant was abandoned, he said, because no workmen could live in the Valley. In this the lecturer was mistaken. He gave Cub Lee the reputation of an early-day "bad man," a deserter from the Union army, and a resident of Death Valley because he was there safe from pursuit. Cub was living there with his Indian wife, his son One Sock, his daughter Peanuts, and other children whose names appear to have been unsuitable for printing.

The interview was somewhat sensational; Monsen tells of finding skeletons of the emigrants of 1849, and from the remains which he saw clustered around a salt-water hole he judged the number to be a hundred. This detail, in the writer's estimation, was a bit of fancy which makes the rest of the lecturer's account open to suspicion.

Three names stand out in humanitarian life-saving work in Death Valley. The best known is that of George W. Parsons, long a campaigner for proper sign-posting of desert places with directions for finding water, and author of a book on the subject. He spent fifteen years in urging the work and was directly responsible for the placing of signs directing the traveler to 167 water holes in California and 138 in Arizona. He collected and had analyzed samples of water from 160 suspected springs. His name

should ever be associated with precautions for human protection of that kind.

Lou Westcott Beck, "the Good Samaritan of Death Valley," as he was termed by an article in the *American Magazine* in 1913, was one of a party of prospectors who visited the Valley. They ran out of water, but luckily found a life-saving small supply at the base of the Panamints. His experiences gave Beck a new purpose; when he returned to civilization he was a changed man. "He had seen sands that were strewn with skulls," the imaginative writer said, "and the sight had put a big idea in his head." Thereafter for many summers Beck and his dog Rufus traveled the desert, piling up rocks and putting up signs. The magazine article said that at one time he assisted in the burial of four men who had died of thirst within two miles of a spring. Rufus was bitten several times by rattlesnakes but lived through it, and Beck made boots which he laced on the dog's legs for its protection.

The third of our notable life-savers is R. J., or "Dad," Fairbanks, long a resident near the eastern rim of the Valley and now a merchant at Baker, California. None know the desert places better than he, and he more than any other man has the confidence of the approximately two hundred and fifty Shoshones and other Indians who inhabit that sterile region. They have shown him over one hundred secret water holes on his promise that he will not reveal the locations to whites while the Indians live. Why this injunction we cannot explain. It did not prevent the use of such places for life-saving when need arose, without betraying Indian confidence. His work of that kind began thirty years ago. Whenever the word went around that someone had failed to reach his destination and was supposed to be lost in that desert country, it was usually Fairbanks who led the search, if he did not go alone. He rescued his fiftieth person from desert death in 1925, it is said, though Fairbanks himself does not claim so many. He has

Photo by Willard

Vegetation on salt marsh in Death Valley

Photo by Clatworthy

Stovepipe Wells

found and buried a number of those who perished, without questioning who would pay any expense that might be involved. He learned to read rightly many signs helpful in life-saving work. Flying buzzards told him the nature of the prospective victim over which they circled; if their flight was low, an animal was nearing its last agonies; if high, it meant that they were warily keeping out of possible danger from a staggering human being. His experiences, if they could all be known, would carry impressive warning to the foolhardy venturer. As an instance, this: Having been told, and long believing, that a body of open water occupied a certain part of the Valley floor, he made a trip to investigate. He found, instead of water, a perfectly dry expanse, though from a distance it had the appearance of water. If one so experienced had been deceived, what would the judgment of a tenderfoot be worth?

The work inaugurated by Parsons is now maintained on a wholesale scale by the Automobile Club of Southern California. Their signs are visible on every traveled route, not only giving directions and distances to usable water but also saving the traveler from possibly disastrous wandering from his proper course. If the Club had done nothing more than this splendid service, its existence would still be worth more than it has cost. It has done much toward making the wastelands safe.

XII. THE WORK OF MAN

When Coleman bought the Winters borax claims he secured also the little oasis at the mouth, or more precisely the sink, of Furnace Creek. Greenland was established where "Bellerin' " Teck had held sway. Contrast with the surrounding desert, rather than any suggestion of storied icy mountains, must account for the designation. When Coleman "went broke," the Pacific Coast Borax Company, succeeding to ownership, changed the name to Furnace Creek Ranch.

The place would not be notable in a more favored region, but in widespread desolation and below sea-level it is unique. Its fertile loam responds generously to cultivation. Pipes bring the water of Furnace Creek to it, without the heavy loss by evaporation and seepage that once reduced the flow; and that stream's warmth, normally 74 degrees, aids in promoting luxuriant growth. The springs flow about 80 miner's inches of water.

A hundred acres of the ranch were fenced, and some forty acres have been used for alfalfa raising. The hay, cut four times a year, was fed to high-grade cattle, providing the beef supply for the one hundred and twenty-five men working at Ryan and the two hundred and fifty at Death Valley Junction. But Bermuda grass got a start in those fields, and much of the alfalfa was plowed up. When we last saw the ranch, in November 1928, a mower was making its way through a veritable thicket of Sudan grass, planted as a substitute. In harvesting there the rake must follow the mower with little loss of time, else the hay becomes too dry.

A cluster of Washington palms towers above the other vegetation, and many sturdy specimens of a lower palm, *Phoenix canariensis,* are grouped about them. The most attractive sight of the place is an orchard of date palms. Isolation and presumed freedom from insect pests led to

this promising experiment. Government supervision was given to the planting and care, and when seen in 1928 the orchard looked as clean as a well-kept kitchen garden. The caretaker said, however, that about half of the trees would have to be taken out. Being seedlings, they produced only woody, useless fruit. Cuttings and shoots from other trees would replace them—and those would have to be rightly selected. About one hundred and twenty-five trees were expected to bear in 1929; the expectancy from each bearing tree was two to four bunches, each forty to fifty pounds, of marketable dates.

Despite precautions, a shipment of trees that mites had colonized reached the ranch, infecting the orchard. That eternal vigilance is the price of a good crop is realized from the caretaker's statement that the entire orchard is sprayed with both dust and liquid insecticides every fifteen days through the whole year.

Electricity is generated by machinery driven by the water coming through the domestic pipe line. The ranch buildings are thus lighted, and so are the habitations of the Indians who are the dependence for ranch labor. Should these revert to a feast of chuckwalla, eaten by incandescent light, it would be a novel combining of the old and the new.

A school was established at that point, little less than two hundred feet below sea-level. A teacher, Miss Nell Henderson, instructed not only ten young Indian pupils but in spare hours also taught ambitious older natives the rudiments of white men's "paper talk."

The benevolent overlord of that region is the Pacific Coast Borax Company, the corporation which has done more than all other agencies to make the Valley better known. It is inseparably connected with the last forty years of Death Valley history. A different corporate name was used for its railroad, the Tonopah & Tidewater, which superseded the twenty-mule teams in transportation,

but that was primarily a borax road. Death Valley Junction was created at the point most convenient to the mineral supply. As an adjunct to the large mill which was built to handle the tonnage of ore from the Lila C Mine, seven miles west, and the mines at Ryan, a unique civic center or more exactly a town under one roof came into being. Imagine a one-story adobe building occupying three sides of a square, and about eight hundred feet in length. A wide arcade shades the inner walls of the great U. Pipes running all through the structure carry heat in winter, coolness in summer; and so well does it fulfill the purpose that the rooms had a temperature of but 89 when in the shade outside it was 130. The long roof sheltered offices, store, recreation places, barber shop, living quarters, hospital and accompaniments, and other places, even to a handsome little theater. The Junction has fallen into the doldrums since the company's principal activity has been moved away, but the mill is still busy handling the special clays that are mined not far off, and the building houses all guests who come.

To H. W. Eichbaum is to be credited planning the first Easter sunrise service held in Death Valley. Men and women journeyed from as far as Los Angeles to be present on that occasion in the spring of 1927. The address was given by Judge Benjamin F. Bledsoe, who paid eloquent tribute to the memory of the many unknown whose lives had gone out in suffering and despair within sight of where the Easter cross had been erected on the summit of a dune. "Dad" Fairbanks, who had saved many lives, "Shorty" Harris, dean of desert men, and many another veteran of the land of the purple mist were present to hear, as the sun peered over the Grapevine heights, a message never before reaching those wilds. At the close, the majestic strains of "Onward, Christian Soldiers" rolled across the barren waste.

Those of that company who journeyed on to the Fur-

nace Creek Inn found this appetizing meal awaiting their attention:

Scorpion cocktail
Pickled creosote buds
Tarantula bouillon
Chuckwalla steak, Indian sauce
Gila monster, à la King
Braised burro tongue
Mesquite beans
Greasewood greens
Whirlwind rolls
Fishhook cactus salad
Desert holly pudding, adobe sauce
Sand dune tarts
Arsenic spring water
Hot borax water
Crystallized salt

Few objects in Death Valley, once seen, are more to be remembered than "Scotty's Castle," situated near where Grapevine Canyon opens into Death Valley. It is at the point designated "Stainінger's Ranch" on the Lida Quadrangle of the Geological Survey. Steininger (probably the correct spelling) was the former owner. When his interest in the premises and other earthly things terminated, the property was acquired by Walter Scott, sometime cowboy, champion rough rider in Buffalo Bill's Wild West show, and man of mystery. A. M. Johnson, a wealthy Chicagoan, is associated with him as owner. They proceeded to erect, a pistol shot from the weathered cabin in which the hermit owner had lived, a structure regardless of expense.

In 1928 Scotty published in a Nevada paper this invitation to stay away:

"Will all my friends and enemies keep away from the shack until done? Then Johnson and myself will stand on our heads and wait on you."

He said "the shack" would be done "forty years from today."

Moreover, there are cords of long concrete posts, said to have been made for the construction of a visitor-proof fence. Two expeditions in which the writer shared found nothing but the most courteous hospitality there, at the hands of M. R. Thompson, superintendent. It may be, nevertheless, that an influx of sight-seers is not desired and that the reader will do well to be satisfied with an insufficient and sketchy description of that marvelous $2,000,000 building, fifty-eight miles from rail connections and in a situation where there is no special scenic outlook or other recommendation than the springs near by.

The figures stated are probably not at all excessive. Scotty himself said in 1928 that the outlay then amounted to $1,550,000, and that $700,000 more would go into the place. An inspection leads to belief of the correctness of the statement.

The castle is built to endure. Its walls are double sides of heavy concrete, with the space between filled with a chemical mixture, which sets, after being poured, in a froth of stone-like hardness, making a heat insulation needed in that situation. The ground area is large, but, because of objections of the management to measurements and picture-taking, cannot be indicated. There are in reality two buildings, connected with a bridge and a space roofed with running vines on rustic supports. The northernmost wing contains, besides apartments for other purposes, a two-story music room, with provision for a $50,000 pipe organ, which at the time of our visit was still in a collection of boxes filling a very large room. The door hardware in that music room alone, we were told, had cost enough to put up an ordinary dwelling, and the room itself, without the organ, represented a $75,000 outlay.

The first story of this wing is partly used for the electric generator, organ-blowing machinery, and other equipment of that kind.

The largest room in the south wing is said to be thirty-

five by sixty-five feet, and twenty-five feet high. It takes the full two stories of height, with a mezzanine floor around three sides. At one end is a huge fireplace, at the other a fountain and a mosaic face in which are set all the colors of stone obtainable in a mineral region of unsurpassed variety. Over this a sheet of living water will ripple to the fountain bowl below. The floor is of specially made tiling, each small square containing a heraldic or other design in color. In a room that has the appearance of a nursery the place of baseboards is taken by a succession of tiles of fantastic conceptions, on which birds are chasing animals or some other unusual suggestion is made.

Woodwork throughout is hand-carved redwood, torch-seared and brush-rubbed. One solid door is covered with bear tracks pressed into the yielding wood.

Among the many rooms are two complete kitchens, each with gas and electric ranges, all inclosed in white tiling or metals and with every convenience that would delight the most exacting housekeeper.

Beneath the building is a huge basement, opening out on a large open-air plunge. A workman in 1929 asserted that the intention is to construct rooms under the plunge, glass-roofed and of course waterproof. That soberly told story is not here vouched for; but anyone who sees that place where money has been scattered like dust in a windstorm would accept almost any assertion of intention as at least possibly true.

Two towers rise into the air, and on them swing weather vanes of wrought metal showing Scotty driving burros on the trail. A separate tower is to contain chimes and a clock with four faces, each several feet in diameter.

That it is not the intention perpetually to exclude all comers from enjoyment of that wondrous building is apparent from the existence of a fine guest house near by.

A note of passing interest is that in 1927 a superheterodyne radio set was taken into Death Valley to test

reception. The experimenter reported that static was entirely absent. It was impossible to get 40-meter signals, but those of 80-meter wave-length came in loud and clear, and many stations on the Atlantic Coast were heard. The first station tuned in was Havana.

Let no one believe that, because men come and go freely over ways that once few eyes ever beheld, the sacrifice of human lives has ended. It will continue so long as there is disregard of common-sense caution and of sad experience, and while the Valley's visitors include those as uninformed as a party who drew up to our evening campfire at Bennett Wells to be directed to a service station.

Park Naturalist Curry writes:

> The broad reaches of the Valley have been pulled together with well-kept highways, made to conform to the topography and blend with the landscape. The wildness of the region, the sense of mystery, the rugged beauty, all have remained unchanged. In spite of the ease of travel, Death Valley has not been civilized or tamed. It will be preserved for all time the same primitive, colorful, unmarred wilderness that awed those pioneers who found and named it.

On the surface, new days, new times, have come. The romance of industry has gone from the buildings at Ryan, through their conversion to hotel uses. Metropolitan accommodations await the passer-by at Furnace Creek Inn and at Stovepipe Wells Hotel. More electric lights than campfires are seen in the night view. Buses roll along with their loads of sight-seers to whom such a land is merely a novel experience. While the minute hand makes its little round, the traveler journeys as far as the pioneers were able to go in two despairing days. He gives a passing glance across sands that the lagging steps of the lost and dying have marked, and disinterestedly views landscapes on which their fading sight rested as the soul was about to leave its tenement.

But these are surface facts; they have not set the

Photo by Wesselmann (courtesy Los Angeles Record)

Scotty's Castle

Photo by Frasher

Kilns in Wildrose Canyon

awesomeness of Death Valley into the past. Many of these trails were broken by the prospector, sunburned to copper red. Even he, an interloper, was less incongruous than today's invader. His ragged denim and worn shoes and his burros were part of the picture; the white collar and the automobile will never be anything else than alien in these surroundings.

The curious flash in and out in a day and have "seen" Death Valley. They are fortunate if they have been attuned in even small degree to appreciate the charm that leads the desert's lovers to prefer it, with all its discomforts, to anything else that wealth could insure. These hills and plains are as they came from the will of the Infinite, and with that will man here seems to come in closer touch than he does in the hurrying crowd. In "civilization" every moment's deeds must be shaped according to their effect on other unimportant, sentient beings. Here, as in the shadow of sky-piercing peaks, he feels the presence of the ages and with each viewing comprehends more and more how infinitesimally trivial the little affairs of mankind may be.

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